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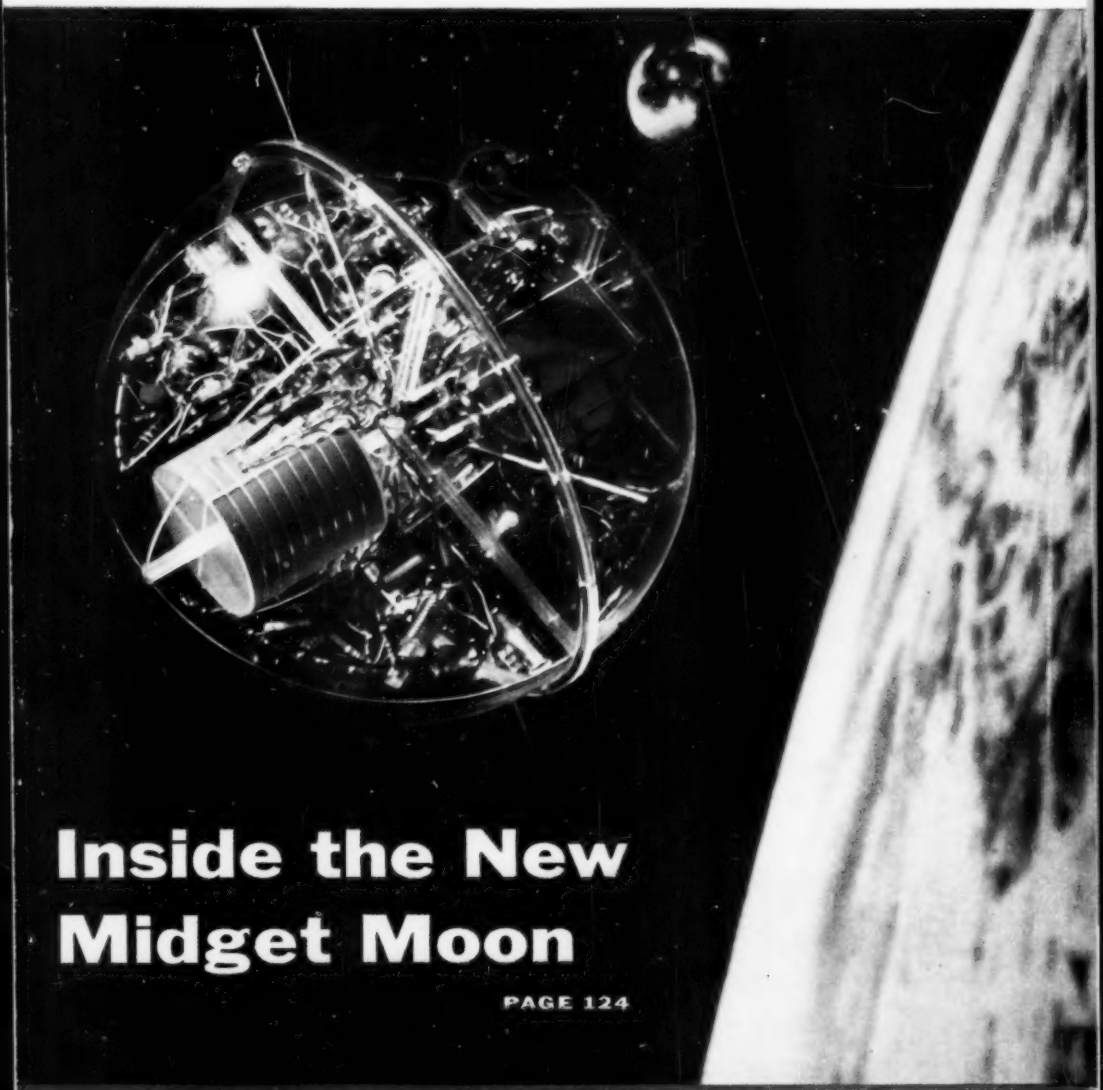
POPULAR SCIENCE

January 35c MONTHLY



Inside the New Midget Moon

PAGE 124

ALL ABOUT AMERICA'S NEWEST LIGHT CAR — PAGE 146

America Discovers the Lifelong Battery

10 YEAR BONDED FACTORY GUARANTEE

The Longest & Strongest Battery Guarantee Ever Issued

The Life-Long Battery is guaranteed for more years than any battery on the market. The ten year bonded guarantee is issued and backed by the factory and is honored by any one of Life-Long's 20,000 dealers throughout the United States. As a further protection to the buyer, the factory ten year guarantee is bonded by a state licensed escrow company. The Life-Long ten year guarantee features free replacement and remains in effect no matter how many times the battery is transferred from car to car. Every Life-Long Battery carries a serial number which is permanently registered at the factory for your protection.

$1,000 REWARD

for anyone who proves a Life-Long Battery will not recuperate within 60 seconds after complete rapid discharge. This reward money is on deposit at the Bank of America.

NEW TYPE BATTERY NOW AVAILABLE FOR AUTOMOTIVE USE

Life-Long Batteries, with the revolutionary new sintered plates*, were originally designed for commercial and industrial use in submarines, locomotives, steamships and large stationary engines, but American "know how" and mass production methods have reduced their costs to the level of ordinary batteries, making them available to the motoring public.

USED ALL OVER THE WORLD

First sold in Europe, tens of thousands of Life-Long Bonded 10-Year Batteries are in daily use throughout the world. To date not one failure has been reported! Life-Long Batteries have been tested and approved by hundreds of large corporations, utility companies, police and fire departments, U.S. and foreign governments.

Many large firms, including original equipment manufacturers, are switching to Life-Long as old-type batteries fail. Where safety is essential—in signal beacons, hospital emergency lighting, standby telephone electric supply systems—you find Life-Long Batteries.

LIFE-LONG BATTERY STARTS TEST ENGINE 606,969 TIMES IN TORTURE TEST

In "torture tests" conducted by an authorized member of the American Council of Commercial Laboratories, a Life-Long Battery started a test engine over and over again—day in and day out, without pause, for more than a year. After making 606,969 starts, the battery finally was worn down! No other battery can equal this record! This Life-Long Battery was no different than the one you can buy for your car. It is good for at least a half a million starts—the equivalent of starting your car thirty times a day for fifty years.

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COLD TEST: Life-Long performs efficiently after "soaking" at 20° below zero for 24 hours.

LIGHT METER TEST. Your lights are 50% brighter with a Life-Long.

R.P.M. TEST: Life-Long spins your engine at least 20% faster, gives you easier, quicker starts.

CAPACITY TEST: Life-Long has 40% greater reserve capacity than ordinary batteries.

LIFE CYCLE TEST: Life-Long produces an incredible 606,969 cycles.

SAVE $70.00 OR MORE!

A Life-Long 10-Year Battery actually costs less than an ordinary battery—saves you $70 or more! On a yearly basis, Life-Long costs you only $3.00 a year while a so-called "first quality" three-year battery costs you $10. Thus Life-Long gives you a direct saving of $70.00 over its ten-year warranty period.

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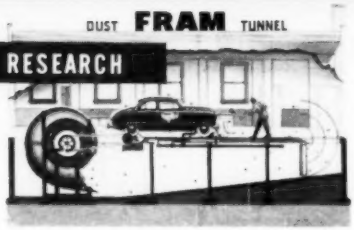

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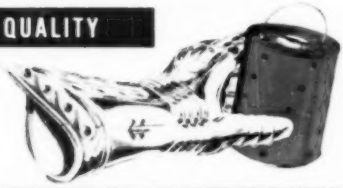

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POPULAR SCIENCE Monthly

Vol. 168: No. 1

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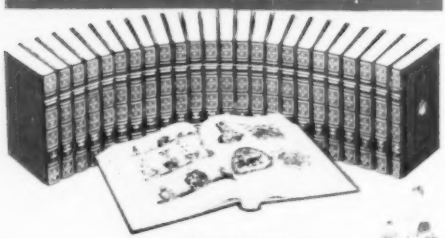

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W. Abbott: "In past 7 months I've taken in over $12,000 almost entirely from cleaning auto interiors."

T. Komari (Japan): "Have 1,000,000 yen contract Duracleaning for U.S. Army."

W. Lookiebill: "We've had 20 years of pleasant dealings. I'm 65 but am setting my sights for 20 more years."

P. Freidinger: "Had a big moth-proof business last year; one job was $322.25."

R. Kimbrough: "Finished First White House of Confederacy and am to Duraclean the Governor's Mansion."

L. B. Hayes: "My 1st month I grossed $170.17. I am now a fulltime dealer."

E. Schenk: "The customers I had on **House and Garden** ads were very pleased. Their furnishings came out beautiful."

Earl Davis: "Our sales increased $17,000 this year over last."

L. Johnson: "Each customer leads to 2 or 3 more. One job two of us cleaned $125 worth in 3 hours."

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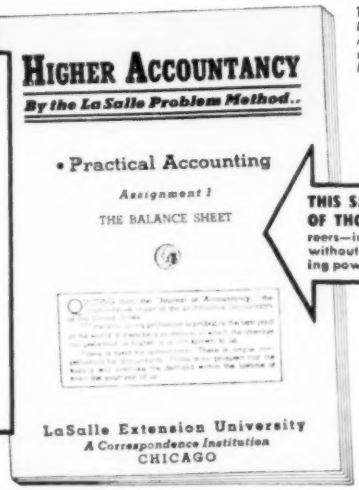

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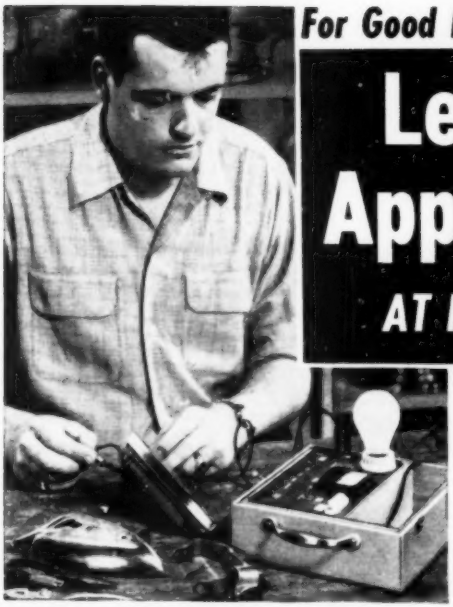

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". . . I was the recipient of my 1st copy a few days ago. I am completely satisfied with the periodical. I also wish to express my appreciation to you for having made the magazine available to me. I shall be pleased to continue my subscription as long as the magazine is available."—W. S., Wash.

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- CIGARETTE HOLDERS, 1¢ each!
- BUTTONS, 144 for 25¢!
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- New 20" T.V. Pic. tubes, $21.95 each!
- Famous brand $18.75 perfume, $1. each!
- 49¢ Xmas window decorations, 10¢ per set!
- $1-$3 Hard cover books, 20¢ each!
- $200.00 Surplus typewriters, $23.00 each!
- 50¢ Everyday greeting cards, 7¢ per box!
- $1.95 Men's Silk Ties, 12½¢ each!
- $1. val. personal cloth name tapes, 40¢ for 72!
- 39¢ Under arm deodorant, 2¢ jar!
- $1. Automatic card shufflers, 9¢ each!
- NEW HAIRNETS, ½¢ each!
- $15.00 Electric Percolators, $5.00 each!
- $1.75 Rudolph Reindeer kiddies toiletry sets, 35¢ each!
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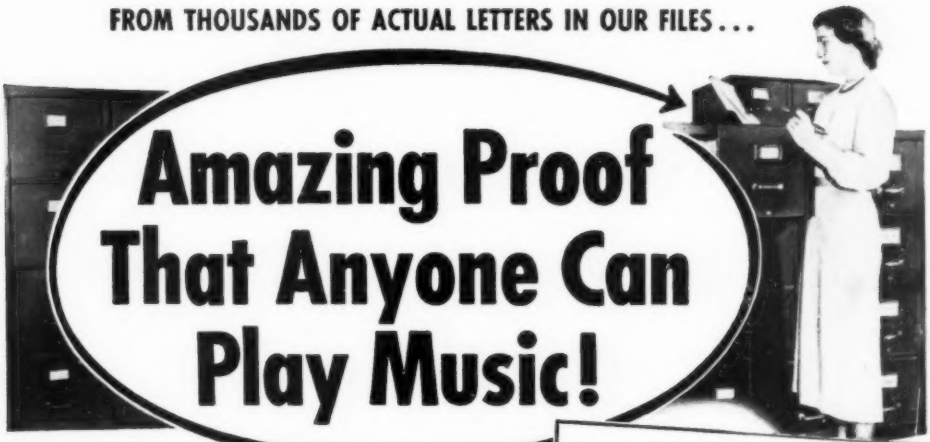

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Lawrence Welk,
Hollywood, Calif.

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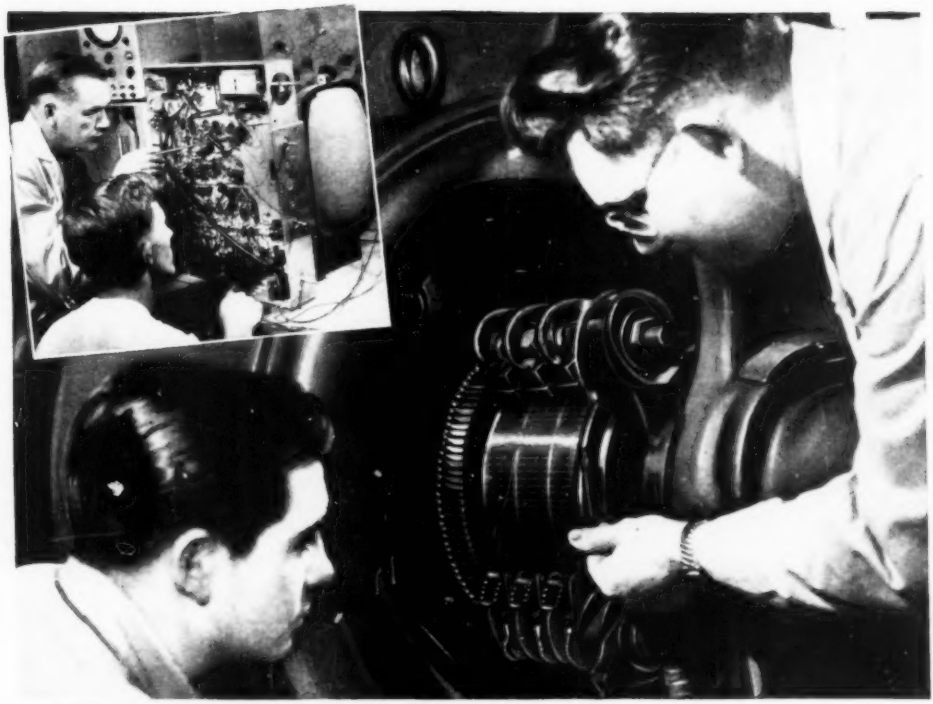

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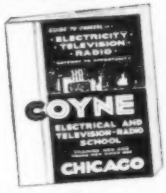

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Letters—

How to Stay Home While Touring

Since the new turnpikes bypass everything, most of them are alike, and the motorist can't tell whether he is traversing Maine, Ohio or Tennessee; similarly, as each motel tends to attain the national standard, the traveler's accommodations each night are more interchangeably the same. Since there is nothing to do at a motel but look at the TV, which is the same that the traveler sees at home, why couldn't he achieve the

same effect on a five-mile closed circuit each day and stay home—in his motel-like, ranch-type house?

CHARLES W. MORTON, Boston

Artificial Gravity

In the article "Disney Plans TV Trip to the Moon" [Nov., p. 99], you say, "Small rocket motors set it [the space station] twirling slowly to create artificial gravity."

That's wrong. Gravity is the force that draws objects to the center, but a whirling motion creates centrifugal force which throws objects *away* from the center.

ALFRED ENDSLEY, Toledo

If you are inside an accelerating vehicle and cannot observe anything outside it, you cannot tell the difference between the effects of your acceleration and the effects of gravity. Twirling is an accelerated motion, and to men inside the space station it would create a very acceptable artificial gravity.

Balanced Wheels Good Anywhere

If you balance the wheels on your car and then rotate them around the car, won't their

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

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balance be upset? If so, why balance the wheels in the first place?

KENNETH A. ROZETT, Brooklyn

Balancing a wheel for a particular location on a car is a practice that only finicky racing drivers engage in. With unimportant variations, a balanced wheel should run equally well anywhere—even on another car.

In Favor of Horns

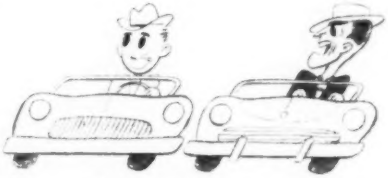
Let's keep the auto horns. [See Letters, Dec. p. 18, for other reactions to a reader's proposal that horns be outlawed.] With the 1956 cars specializing in safety features, can you imagine their throwing out the horn? Most drivers have learned to give the button a quick little "beep" for non-emergency signals. These beeps are usually intended to prevent emergencies, especially in signaling your presence or approach to another driver who may not otherwise see you in time.

The louder blasts are to get immediate action out of the other fellow when the emergency does not grant time for a polite hint, as when a pedestrian steps in front of you while he is looking in the other direction.

I'd rather fray the pedestrian's nerves than fray the whole pedestrian.

FRANK VOSLER, Louisville, Ohio

Did you ever start to pass a car and find yourself alongside a daydreaming driver who



drifts into the passing lane, running you off the road? A horn comes in handy then!

DON DAVIS, Nashville

Official Praises PSM's TV Poll

Thank you for sending this material [the final results of the poll on pay-as-you-see television, which you'll find on page 202 of this issue]. I find it most interesting.

RICHARD A. MACK, Commissioner
Federal Communications Commission

The Easy Way

Gus Wilson did it the hard way when in your September issue he used a weak makeshift spring to get that outboard motor going. Could have merely turned both broken

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pieces of the valve spring end-for-end and replaced them in this position. With one broken end against the valve-spring seat and the other broken end against the opposite seat, or cylinder, the two "finished ends" would not telescope or screw together—as two broken ends do. This simple trick may be used if necessary for many miles even in racing engines.

WILLIAM MORROW, Antioch, Tenn.

Plea from a Bike Rider

I am a bicycle rider. I consider myself pretty careful while on my bike. I try not to interfere with traffic in any way. But sometimes you drivers don't cooperate. You

open doors on the driver's side without looking first, thereby either making me skid to a stop, miss your door by inches, or even hit you. Sometimes you're in the left lane and suddenly you move over to the right lane without signaling. Besides endangering me, you endanger other drivers by not signaling. And then there's the driver who creeps behind me and blows that new sharp horn, scaring me half to death.

DONALD SIEVERT, Brooklyn

Hand Faster Than Foot?

Why not use the horn ring to operate the brakes? I think this would be even faster than Mr. Hemphill's accelerator-brake system [Sept., p. 121].

A. ZANELLI, Tampa

Tesla Fans Like Motor Story

The manner in which your article, "Those Little Motors Everybody Uses," [Oct., p. 157], presented the evolution of the AC motor is to be sincerely complimented.

LELAND I. ANDERSON
The Tesla Society, Minneapolis

How to Unhook a Battery

An item in "I'd like to See Them Make" for September proposed a plastic-coated

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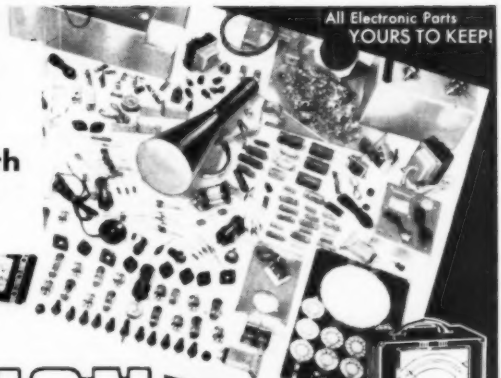

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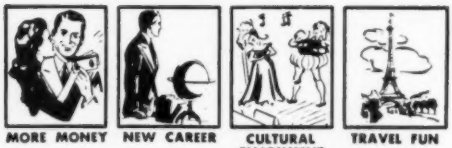

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shockproof battery wrench. Such a wrench might be worthwhile in some applications but is unnecessary in ordinary battery work.

The proper way to remove battery terminals is to remove the ground terminal first. If the wrench touches the car structure while removing the ground terminal there will be no arc, since the wrench and the car structure are both at ground potential. With the ground terminal removed from the battery it is then impossible to complete a circuit from the hot, or remaining, terminal to any part of the car structure. Install terminals in reverse order; the hot terminal first, then the ground terminal.

V. F. Rossie, Inglewood, Calif.

Motors . . . Motors . . . Motors

The article in your October issue, "Those Little Motors Everybody Uses" [p. 157], mentioned that the average family uses six electric motors around the house. I guess we must be good customers for the electric company. I looked around my home and found 22 motors: 4 electric clocks, 1 garbage disposer, 1 refrigerator, 1 freezer, 3 record players, 2 electric drills, 1 washing machine, 1 dryer, 1 ironer, 2 fans, 2 vacuum cleaners, 1 food mixer, 1 furnace blower, 1 electric lawn mower.

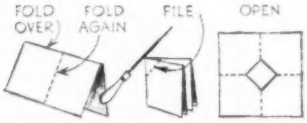
Alan Kogan, Detroit

Easy When You Know How

I've been told it is possible to make a perfectly square, sharp-cornered hole in a piece of sheet metal with a round (rat-tail) file, but I don't believe it. Isn't this in the same class with the left-handed monkey wrench, the bucket of vacuum, and a yard of skirmish line?

Mark Roberts, Santa Monica, Calif.

Not quite. It is possible to file a square hole in a piece of thin, ductile sheet metal



with a round file. Fold it in half, then in half again. File down to a 45° diagonal across the corner where the folds meet.

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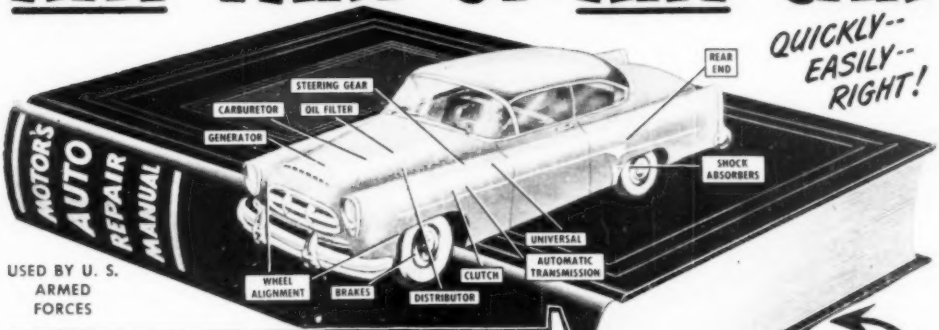

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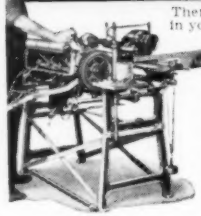

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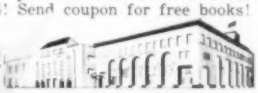

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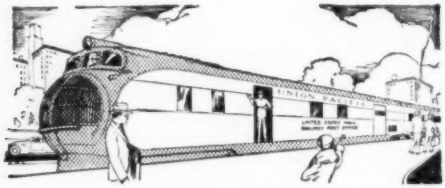

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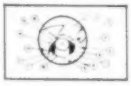

Note electrodes closely. A circular arcing area (four concave segments). Gap being the same from all points. Electricity has property of arcing from coldest point. Current also arcs more readily from apex of two planes than from face of a flat, metallic surface. Note that there are 16 apexes (where two planes meet) — all the same distance from the center electrode.

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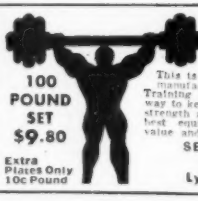

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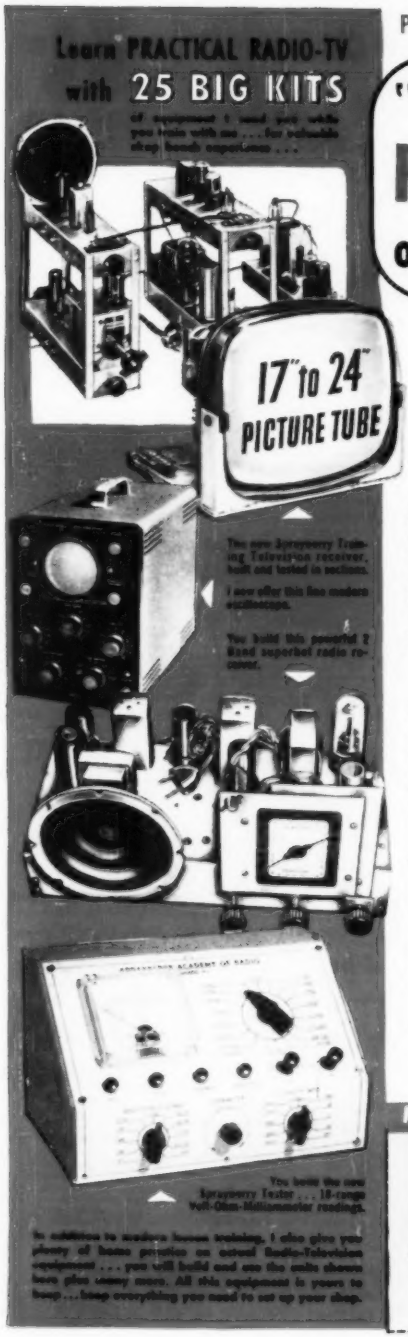

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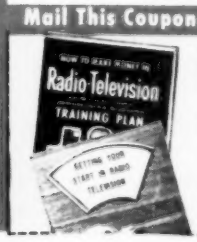

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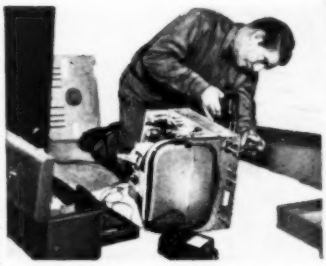

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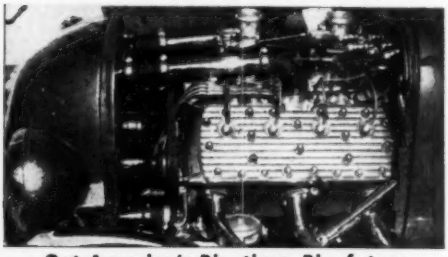

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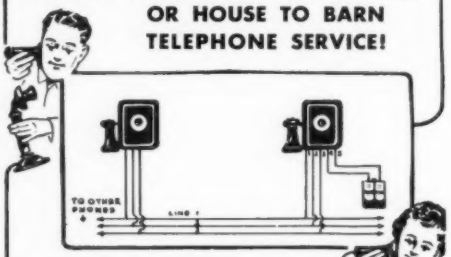

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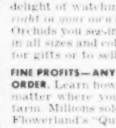

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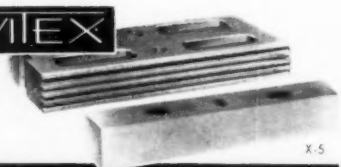

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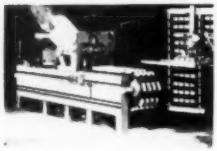

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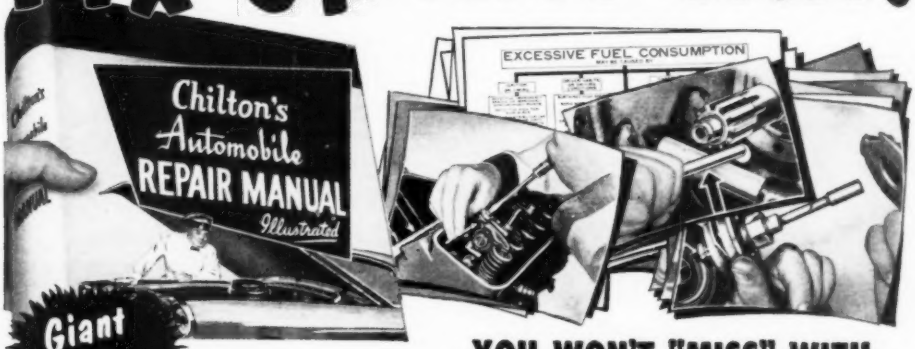

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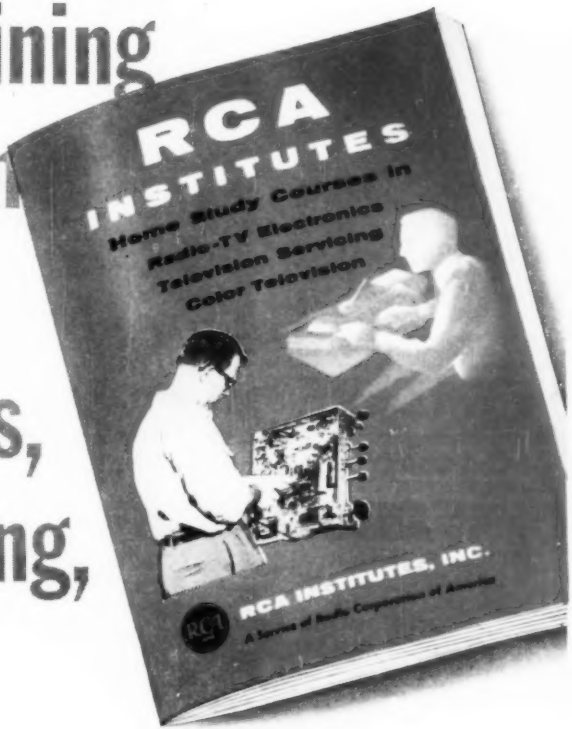

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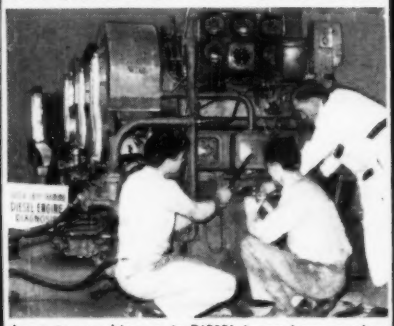

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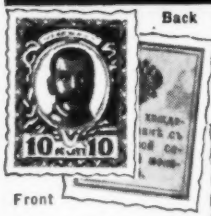

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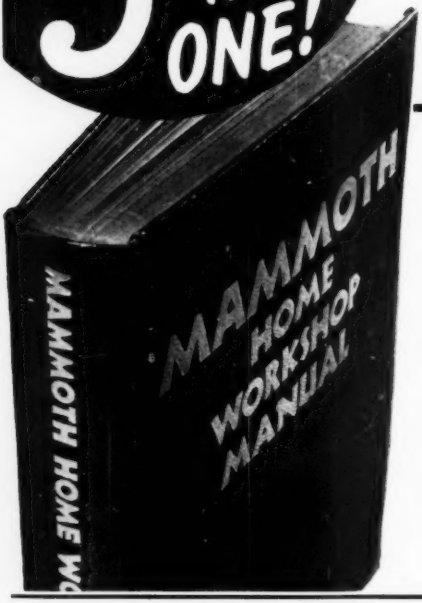

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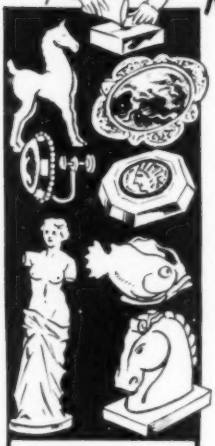

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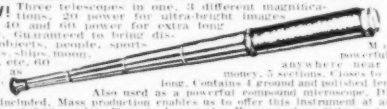

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A manufacturer in Chicago is eager to pay good money for new plastic toys or houseware inventions with wide appeal.

A large company in St. Louis assures big cash rewards for ideas or inventions relating to paint specialties. A Boston company pays inventors 5% of gross sales for new ideas for gadgets and inventions for the home, automobile, or garden. An electronics firm will pay big money for new accessories to improve TV reception.

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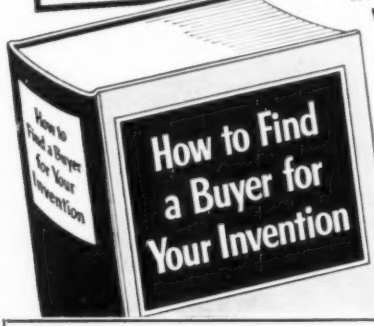

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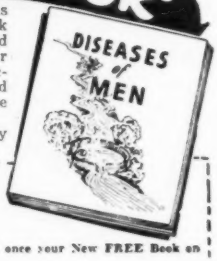

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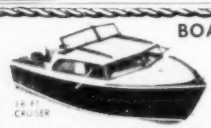

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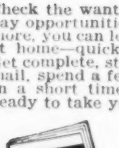

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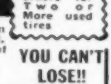

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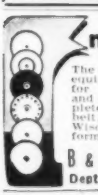

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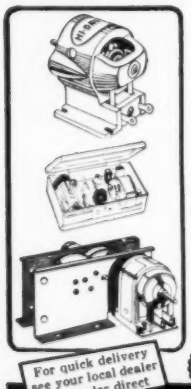

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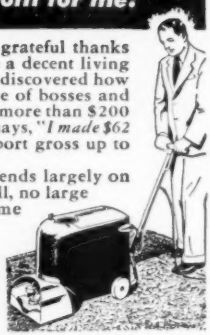

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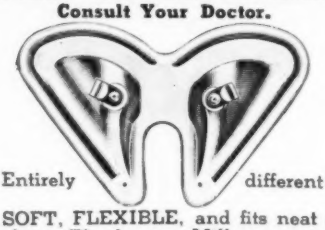

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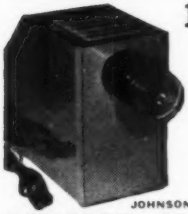

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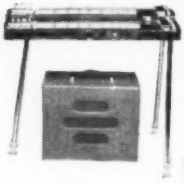

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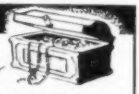

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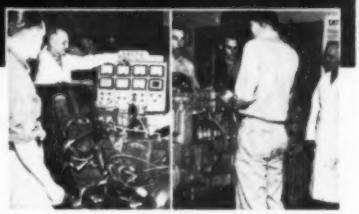

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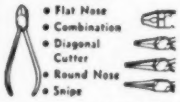

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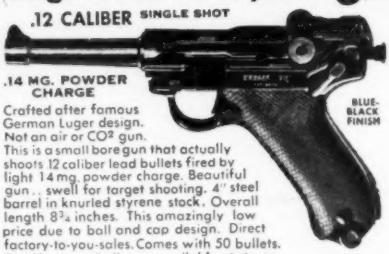

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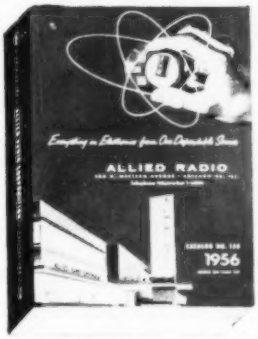

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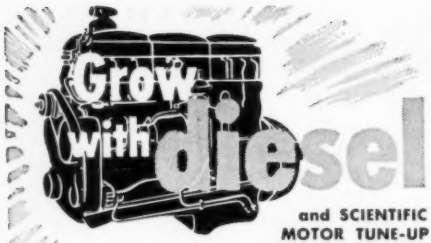

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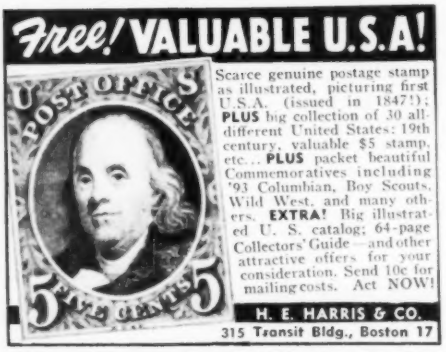

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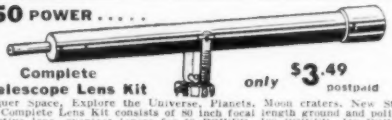

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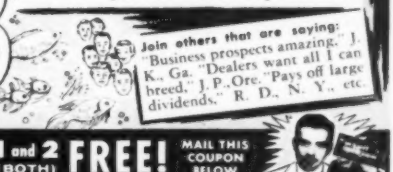

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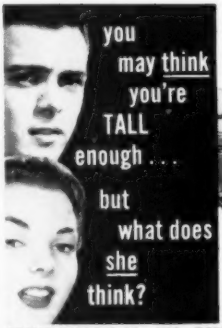

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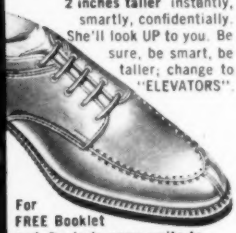

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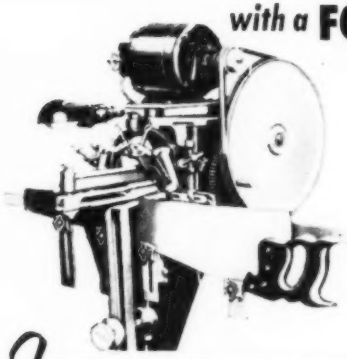

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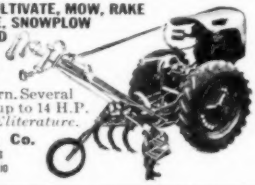

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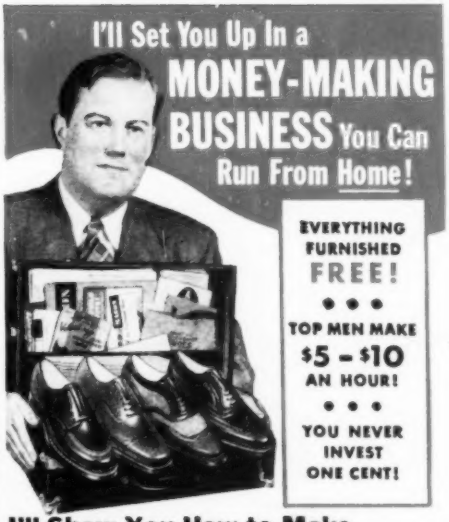

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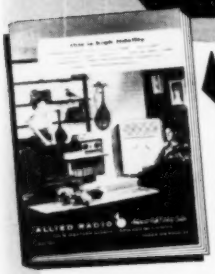

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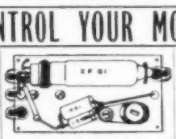

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What a fellow makes in his regular job today is hardly enough to make ends meet. Higher taxes, higher costs of food and rent and almost everything else raise hob with the savings account. And I say that what a fellow puts away is even more important than what he makes. It would worry me sick if I couldn't save a little against a rainy day.

And that makes it almost necessary to make some extra money. There are lots of ways to do it, too. The magazines and newspapers are full of ads for agents to sell things. But if I had to make a living by selling, from house-to-house, I'm afraid I'd starve to death. I like to make something with my hands and either sell it by mail or let the stores sell it for me. There are lots of people like me.

Another thing: Lots of men—and women, too—don't want to get mixed up with something that might hurt them on their jobs. They want a plan they can operate at home—in spare time—one that they can work at any time they please and one that doesn't need any rented store or hired help. And that's where my little money maker rings the bell.

Let's say you're like me. You want to make some extra money but you don't want to do any selling. All right—take a look at what you can do with this machine. I'll give you some facts that I discovered and your own common sense will tell you they're true.

If you're going to make something, it ought to be something that lots of people want—something that lots of people buy. It shouldn't be something that sells at just certain seasons—but all year round. And, it shouldn't be any flash in the pan. It's got to be steady—year after year—something that's not here today and gone tomorrow.

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Every year millions of mothers want their babies' first shoes preserved as mementos. These mothers have the shoes "bronzed" as they call it—by electroplating. Electroplating coats the shoes with copper and preserves them forever. And there's no big company that has a corner on the business of metalizing baby shoes. Almost all of this work is done by little fellows in their kitchens or basements. Lots of orders come to you by mail when you send out circulars letting mothers know you can do the work. Lots of stores take orders, but they have to turn the work over to you. There are six or seven ways to get orders without making any house-to-house calls. The big job is keeping up with them.

You see, you can clean up six pair shoes in a few minutes. In a few minutes more you can dip them in the hardening solution like you see in the picture. Then you spray them with a conductive coating and hang two pair in the tank on copper wires. Just turn the switch and walk away. The machine does the rest. Eight hours later those shoes are ready to take out of the tank, burnish and mount and ship or deliver. Two pair every eight hours, whether you are asleep, awake or at the movies. The materials cost 54c a pair.

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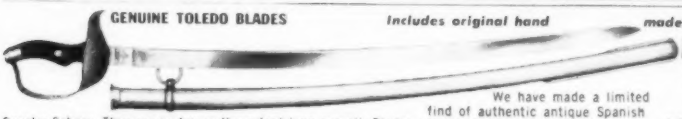

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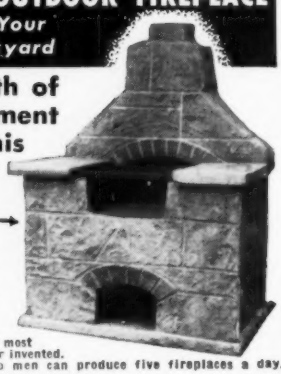

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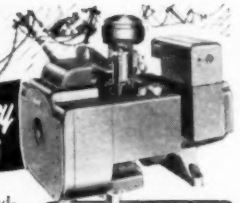

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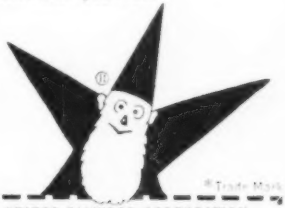

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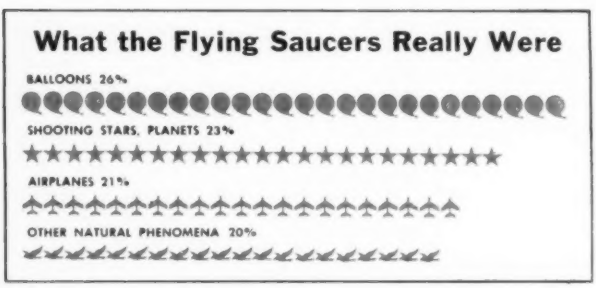
POPULAR SCIENCE MONTHLY

LATE NEWS...

The elusive reversed atomic particle – the antiproton – was finally trapped in the University of California's bevatron atom smasher. Antiprotons are negatively charged protons, opposite to the positive protons found in all matter. They have no practical use—yet.

Flying saucers: real and imaginary. The official Air Force report on the Little Green Men is out. It says there aren't any. Ninety percent of the sightings have been satisfactorily explained, the Air Force says (see chart below). Of the unexplained 10 percent, it adds: "All the unidentified aerial objects could have been explained if more complete observational data had been available." The Air Force also has revealed that you may now see real saucers—Avro Ltd. of Canada has a contract to make a disk-shaped aircraft (PSM, Sept. '53, p. 105).



Milk spiked to prevent disease is suggested by two professors at the University of Minnesota. They injected vaccines for assorted diseases into cows' udders and found that the cows then produced quantities of antibodies against the diseases. The antibodies appeared in the cows' milk—and in the bloodstreams of people who drank the milk. Theoretically, a daily ration of this protective milk would give you as much disease immunity as if you had been vaccinated yourself.

The spaceman's view of the earth satellite on our cover was snapped in PSM's photo studio. A three-way composite, it was made by Hubert Luckett. The satellite model was shot alone. Then, on the same film, a 15-minute exposure copied a slide image projected on a screen. The slide was a composite of a moon picture from Lick Observatory and an earth view taken from a Navy rocket 200 miles up. Hayden Planetarium astronomers helped assure accuracy of the photograph.

The jet race is on among U.S. airlines. Nearly 200 turbojet transports—Boeing 707s and Douglas DC-8s—have been ordered by American, National, United, Pan American and Eastern. American claims that it will be first with a domestic jet ride—Los Angeles to New York in four hours 15 minutes—by mid-1959.

Toll road easier on car. After running a test car over both an expressway and a parallel free highway, Bureau of Public Roads experts found that:

- You use more gas on the toll road because you go faster.
- You use the same total amount of gas either way—the expressway is more direct.
- You can save gas on the expressway if you keep your speed down (around 40).
- You use the brake 34 times as much on the free highway.

Car buyers want safety, even if it costs extra. Ford reports that 70 percent of its '56 models are ordered with dashboard padding, and nearly 25 percent with seat belts.

Good book. Rachel Carson, whose *The Sea Around Us* delighted PSM readers (see excerpt, Nov. '51, p. 114), examines marine life nearer home in *The Edge of the Sea* (Houghton Mifflin, $3.95). In beautiful prose, she reveals a world that many have looked at without ever seeing.

IN RETURN FOR CHARACTER ...A CAREER

Because the finest single attribute anyone can offer is character, this, basically, is what IBM asks of its people, whatever their special aptitudes or abilities. IBM offers them in return—not just a job—but a career.

IBM electronic field technicians, for instance, receive more than training and early responsibility; they have the opportunity to work with the world's largest computer, use all the latest testing equipment, employ the finest computer testing techniques yet devised.

Above all, they have the satisfaction of joining the electronics industry's most advanced program, destined for long-range national importance.

You could ask for no finer future.

If you are between 19 and 32 and have at least a 2-year technical school background, with emphasis on electronics, you can do important work on COMPUTER INPUT-OUTPUT functions. Write: Nelson O. Heyer, Room 701, IBM, Neighborhood Rd., Kingston, N. Y.

The 702 Electronic Data Processing Machine, typical of advances that have made engineering work at IBM one of the most provocative experiences in electronics.

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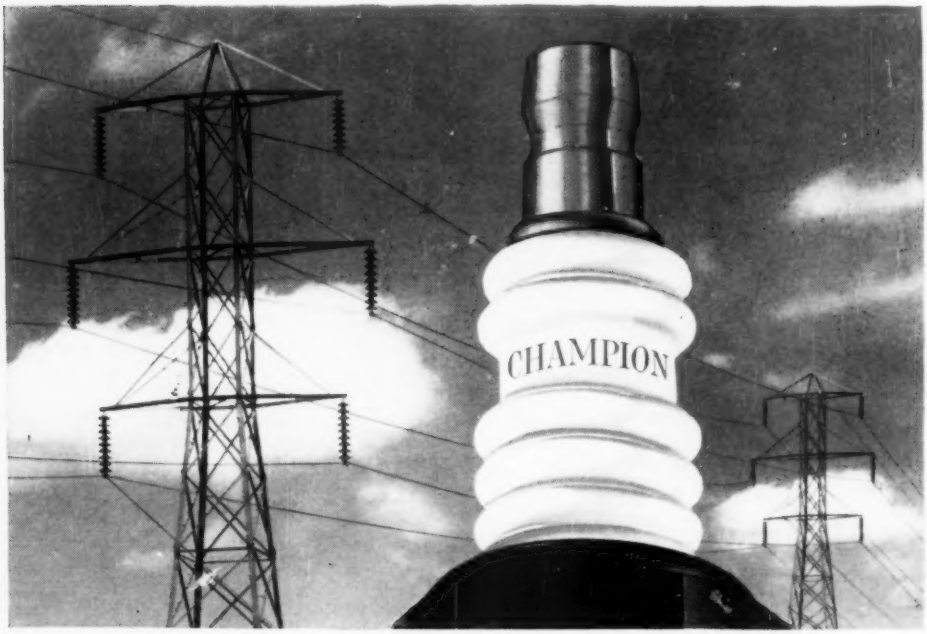
Champion Spark Plugs are ribbed like power line insulators to give you faster starting!



Don't be pushed around this winter—get a new set of full-firing 5-rib Champions NOW

You can see at a glance one of the big differences between Champion Spark Plugs and all others.

It's the exclusive 5-rib construction which protects you against power losses in your engine.

Like the multi-ribbed insulators you see every day on high-tension power lines, these 5 ribs increase the insulator length by as much as 20% over straight line insulators.

This construction permits higher voltages to be put through the spark plug to the firing end—where it belongs—before "flashover" occurs. "Flashover" simply means an external shorting of the plug which causes hard starting, misfiring, wasted gasoline and crankcase dilution, to say nothing of excessive drain on your battery.

Only Champions have the 5-rib construction—an identifying feature to remember when you need new spark plugs.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

POPULAR SCIENCE Monthly

Mine Rescue Teams Race for U.S. Championship

Champing at the respirators, a team awaits signal to find "victims" in a simulated mine.

Prize for fastest and smartest handling of a disaster problem keeps volunteers on their toes.

RACING against the clock, the country's top mine rescue teams recently battled imaginary gas and cave-ins in the seventeenth National First Aid and Mine Rescue Contest. Plastic-partitioned tunnels and roped-off aisles in a big auditorium at Knoxville, Tenn., provided identical "mines" for the seven contesting five-man teams.

The problem of each team was this: "Locate four men trapped underground by an explosion and bring out any vic-

1 LOOSE ROCK? Team captains must probe all "mine openings" with their tap sticks before leading their men into areas beyond them.

2 "MINE ROOM" IS SAFE TO EXPLORE, so a captain (in this photo, the leader of the winning Hendrix team) enters unfamiliar zone.

5 LIVE MINER IS FOUND in this plastic box. The problem: Place him under oxygen, load him on a stretcher and bring him to the surface. All work is done under the expert eyes of U. S. Bureau of Mines judges, who dock teams points for the slightest oversights.

tims found alive." Judges docked the teams one point a minute for any search lasting more than half an hour.

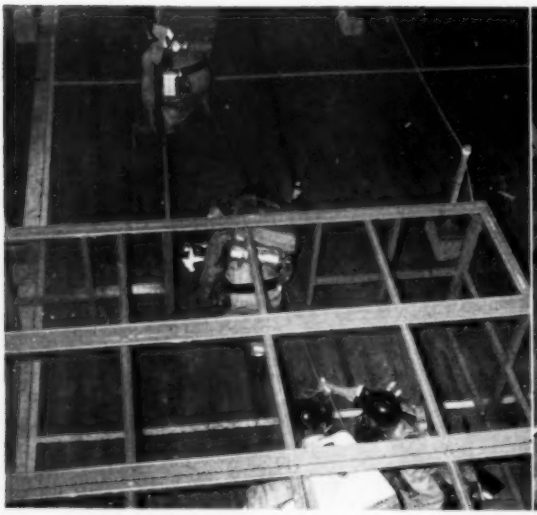
Except for the make-believe mines and dummy victims, all the props were real.

Connecting each team with the fresh-air base, or starting point, was a lifeline identical with those used in actual mine disasters. Each man breathed oxygen from a pack on his back. Before entering any new section of a mine, teams had to make careful checks for gas and loose rock. The watchful judges chalked up demerit marks for every slip-up.

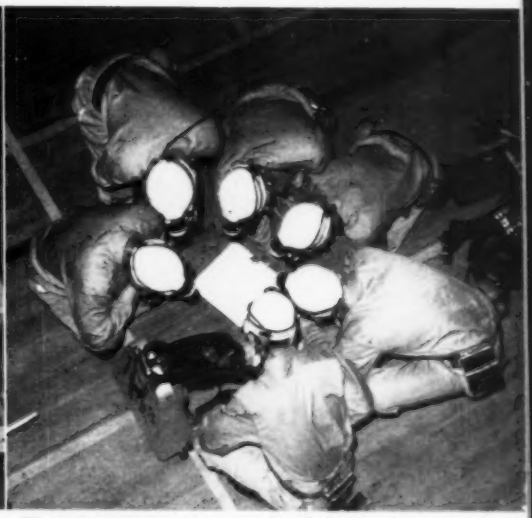
Winner was the rescue team from the Hendrix Mine of the Consolidation Coal Co. of Jenkins, Ky. Its equipment and methods conform to the code set up

3 DISREGARDING DUMMY VICTIMS pronounced dead by the team captain, a crew checks for gas before continuing search for other miners.

4 SEALING OFF MINE ROOM containing gas is part of the job. Captain uses a copper hammer head and nails to prevent explosive sparks.



6 TRAPPED MINERS are now all accounted for, so this rescue team returns to its fresh-air base, following the all-important lifeline.

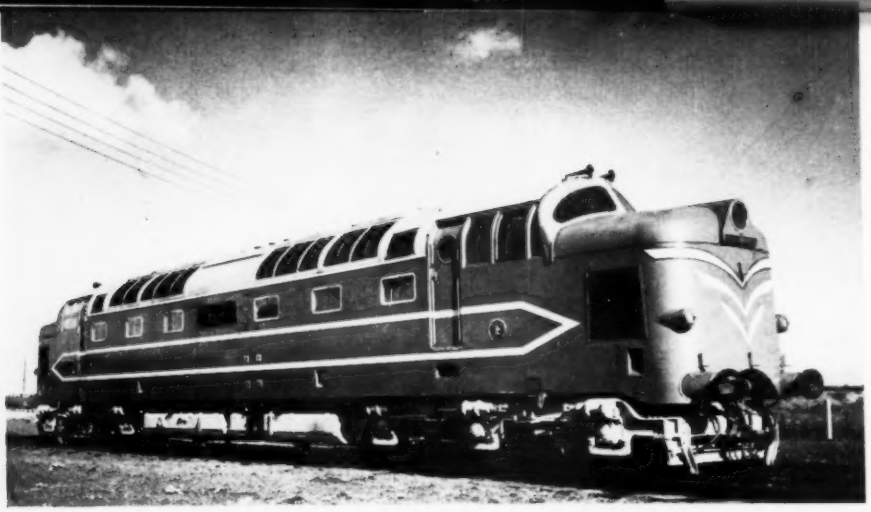


7 LAST STEP—turning in a detailed map showing everything found in the mine—calls for careful check before signaling "all through."

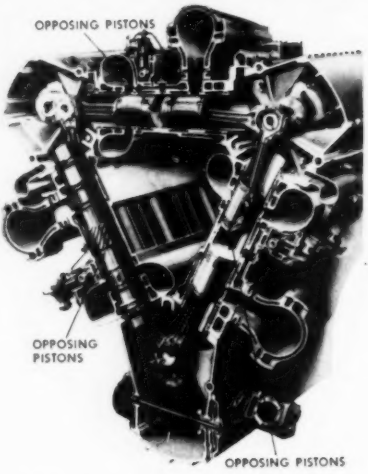
by more than 500 mine rescue teams throughout the country. Such teams are always ready to leave their own jobs to help out in any disaster within practical traveling distance. They hold team practice at least once a month, but get little if any extra pay.

In addition to the rescue award, there are prizes for first-aid work and for the highest combined score in both fields.

Says J. J. Forbes, Director of the Bureau of Mines, one of the sponsors of the biennial contest: "We've trained 75,000 men to perform rescue work while breathing from oxygen equipment. These contests point up the work and we feel that they promote safety in the entire mineral industry."—*George Laycock.*



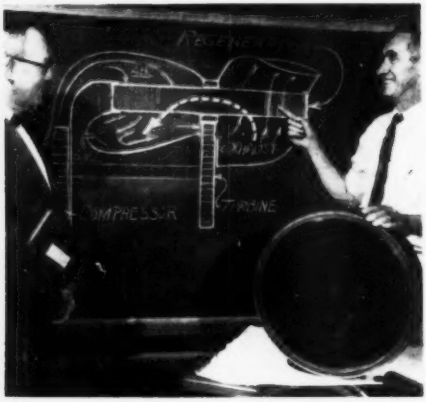
Huskiest Diesel Locomotive Gets Power from 72 Pistons



UNUSUAL engine design makes this new British locomotive the world's most powerful single-unit diesel. Each of its two 1,650-hp. Napier engines has 36 pistons, housed in 18 cylinders arranged in six parallel triangles (right). Fuel is injected at the center of each cylinder, driving the opposed pistons apart. Piston thrust is transmitted to three crankshafts geared to a common output shaft.

This "delta" design, combined with two-cycle operation, results in an exceptionally compact engine weighing only 8,725 pounds, or 5.2 pounds per horsepower. By way of comparison, a four-cycle, V-16 engine—a type that is commonly used in American diesel locomotives—develops 2,250 hp. and weighs about 16 pounds per horsepower.

Compact Heat Exchanger May Speed Use of Gas Turbines in Cars



A WAY to cut in half the fuel consumption of kerosene-hungry gas-turbine engines—and perhaps make them suitable for automobiles—has been devised at the University of Illinois.

The nub of the development is a "regenerator" (foreground) about the size of a suitcase. A heat exchanger, it's a disk containing more than 63,000 holes per square foot. As the disk spins, exhaust gases race through part of it in one direction, heating it, while air comes through another part of it in the opposite direction. The disk heats the air before combustion. Result: Less fuel is needed. A metal strip seals exhaust gases from incoming air. The regenerator's compactness makes car application possible.

These Two Robot Machines Even Look the Part

A PAIR of "mechanical men" are employed at the Ryan Aeronautical plant in San Diego. They are scallop and drill heads that trim 60 scallops and drill 150 holes in each of five jet-engine housing assemblies in a record hour and a half. The operation on standard machines required six hours. But they haven't completely replaced us humans: it still takes a man to adjust them, change bit sizes, and start them on their way.

Mechanized task forces launch a great scientific assault on the

Secrets

Preview of this month's Antarctic landings: A recent British party fights its way ashore.

"HOW one wishes for time and unlimited provisions!" cried Sir Ernest Shackleton, the British Antarctic explorer, in 1908. "Then indeed we could penetrate the secrets of this great lonely continent."

The whole story of Antarctic exploration—before this January—has been a story of not enough time and not enough provisions. But today, expeditions from 12 nations, converging on the Antarctic, plan to take three years, or until 1959, to penetrate its secrets.

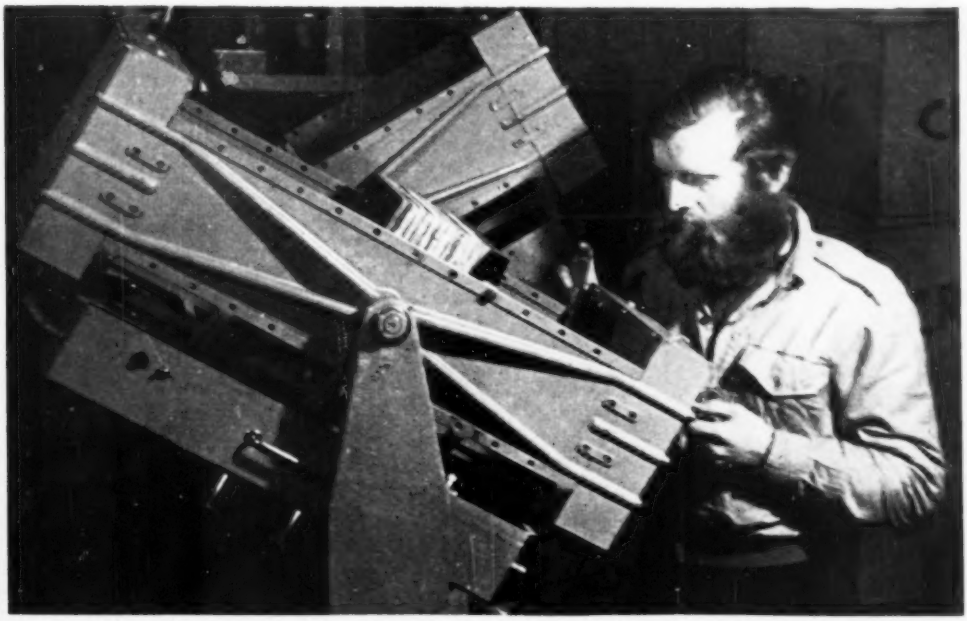
They are taking plenty of provisions, too. The U.S. has enough to set up entire little cities at the South Pole and other points indicated by American flags on the map above. Other countries have enough to dot the continent with the camps that are shown by the pennants.

The first explorer that the U.S. will drop at the South Pole is not one of the men who will live there, but a mechanical grasshopper the size of a man.

This is a torpedo-shaped object, about five feet long, 174 pounds in weight, its thickness about that of your body.

On-the-spot reports. When it reaches the ice after being parachuted over the Pole, the grasshopper will lie down for 30 seconds. Then it will put down six legs, like stilts, and raise itself up, like a grasshopper. Next it will shoot up an antenna and start broadcasting temperature, relative humidity, atmospheric pressure and wind direction and velocity. It will also broadcast its own exact location. It will stay on the air for about six weeks

of the South Pole



Tons of instruments will probe upper atmosphere: An Australian with cosmic-ray telescope.

THIS YEAR'S BASES will be made up of prefabricated buildings similar to these shown in '55 Australian camp at Mawson. But U. S. bases, unlike this one, will never be free of ice.

Jato- and ski-equipped Navy Neptune P2V patrol bomber, one of a dozen types of planes for

M29 Weasel, one of the smallest sled haulers, is tested with sled train before the expedition

before its powerful batteries run down.

Only 10 men in the parties of Amundsen (1911) and Scott (1912) ever got to the Pole on the ground. (Scott and all his men died on the way out.) Though Rear Admiral Richard E. Byrd, who again is heading the U.S. expedition, has flown over the Pole, Scott's are the latest ground-level weather observations available. Hence the grasshopper. What it reports will tell the U.S. expedition if it is feasible to land planes at the Pole.

If it is, the Navy will start by trying to put down Otters to establish the base. If it is not, some of the Air Force's biggest cargo-carrying planes will try to establish the little city at the Pole by parachuting everything necessary, up to large snow tractors weighing 35 tons.

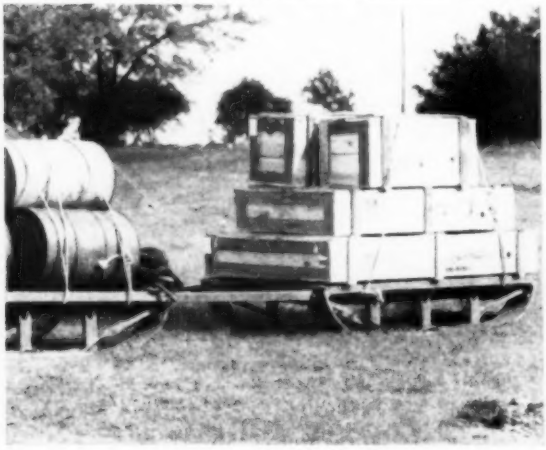
Main objective. The secrets that our South Pole base wants most to obtain—and the Antarctic secrets that all the expeditions are primarily after—are exactly the same secrets that the grasshopper may explain: what gives with the weather.

Everybody knows that Antarctic weather is the world's worst:

Blizzard and blow,
Gust, squall, and snow,
Hazard, discomfort, and storm.

Why is Antarctic weather so important? It is the last unmapped area on the weather map of the world. This gap must be filled, because Antarctic weather af-

U.S. expedition, practices for take-offs from snow, leaves. Cab protects driver against the weather.



If machines bog down, dogs will—again—go on

THE DOGS above, shown at the South Pole, helped Amundsen's party discover it in 1911. The dogs below, part of three nine-dog teams, will assist the '56 U. S. expedition. The huskies go through weather that stops planes and over land that stops tractors. They can keep traveling even when the temperature drops down to minus 50 degrees.

fects hurricanes on the east coast, the corn crop in Iowa, heat waves in Texas, floods in Great Britain, ice jams in Russia.

At all U.S. bases Americans will obtain weather data by Rawinsonde balloons.

"Rawinsonde," explained Lt. Cmdr. John Mirabito, an aerologist now in the Antarctic, "is an abbreviation for radar-wind-sound. Rawinsonde balloons are junior-size satellites. They climb to 90 or 100,000 feet and, equipped with portable transmitters, will send us temperature, relative humidity, and atmospheric pressure at intervals along the climb."

International effort. Information from the grasshopper, Rawinsonde balloons, all U.S. ships, bases, planes and trail parties, and from the expeditions of the 11 other nations, will be coordinated onto something else new for the Antarctic: a daily weather map.

The map will be sent by radiophoto to Australia, Washington, D.C., and such Antarctic bases as may have equipment to receive it.

Altogether, there will be hundreds of U.S. naval and military men, scientists and explorers in the Antarctic between now and 1959. The exact number is undetermined. More U.S. fleets in '56, '57 and '58 will bring in more people.

To give them all a chance to do real scientific work, the U.S. is shipping south

[*Continued on page 269*]

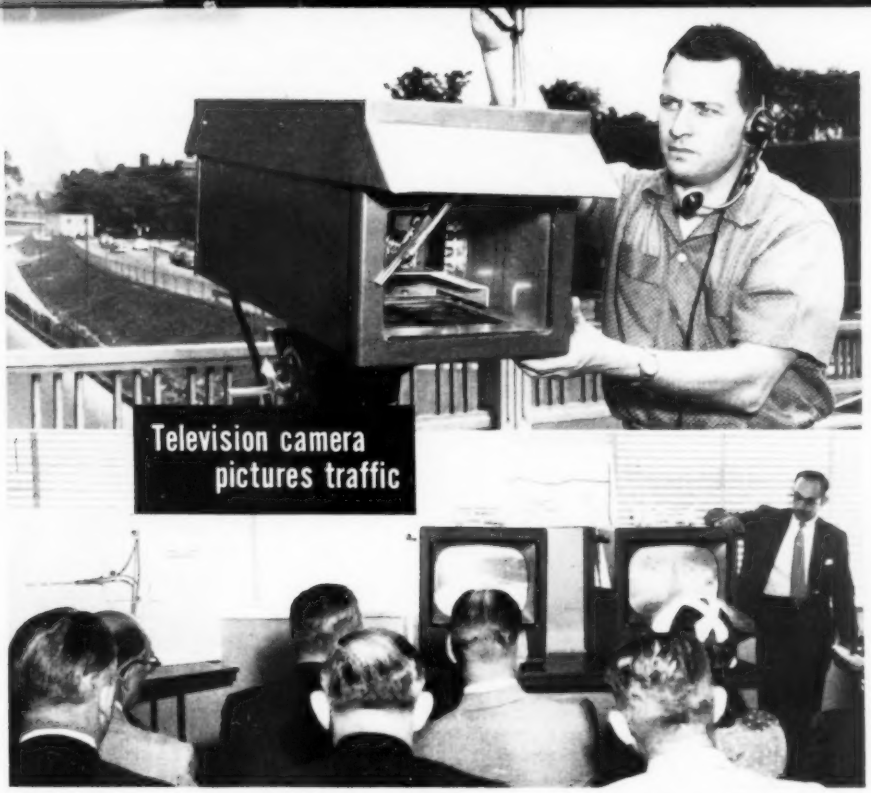
Precast Concrete Chapel Will Take Guam's 120-Mile Winds

SEVEN-TON concrete slabs hauled to the site by truck (right), and bolted to 35-ton V-shaped arches rising 50 feet above the ground, form the central chancel and nave of this typhoon-proof U.S. Air Force chapel on Guam. Precasting the roof panels and most of the concrete walls 12 miles away cut down costs and time spent on the construction of the building.

Decorative effects are created in the chapel as light falls through glass brick and small windows, stained Air Force blue, at front and rear. Louvers in the roof and exterior walls admit breezes and more light.

Wavy Concrete Roof May Save You Money on Your Next House

DESPITE its long name—hyperbolic paraboloid—this may be the shape of roofs to come. University of Michigan engineers testing the 10-by-20-foot model above find the strength of its ¾-inch reinforced concrete equivalent to that of a four-inch flat slab. They hope to keep costs low by precasting. The metal columns are used in testing.



Detroit Seeks to Keep Cars Moving by Ingenious Use of TV

WITH television cameras set up at three strategic points on its John Lodge Expressway, Detroit hopes to smooth out traffic snarls before they occur.

Each camera, in a weatherproof housing complete with windshield wiper (photo at top), picks up a continuous traffic picture and flashes it to monitor screens at headquarters (lower photo). From there emergency patrols can be sent to untangle jams.

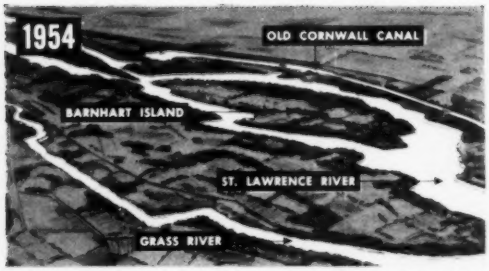
It's an experiment now; if successful, the scheme may be applied in other cities.

Chicago Controls Traffic Lights by Radio

RADIO signals coming from Chicago's tallest building now control the traffic-light time cycle during rush-hour periods at 12 of the city's busiest intersections. It's the world's first such system.

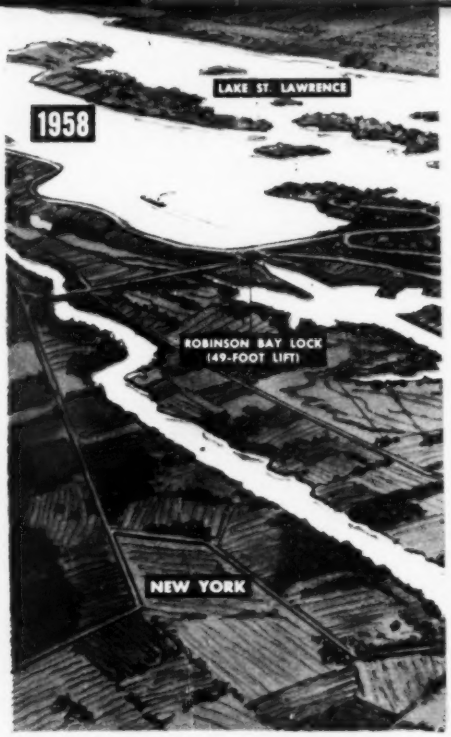
At right, engineers in charge of the installation are field-testing one of the new light units at GE's Syracuse Electronics Park.

In operation the broadcast radio signals change and synchronize the lights at the 12 intersections in order to speed up traffic in the direction of greatest flow.



Before Seaway and power projects began, Barnhart Island split the river into two boiling channels.

Today, north channel has been unwatered, the south narrowed for power-plant and dam building.

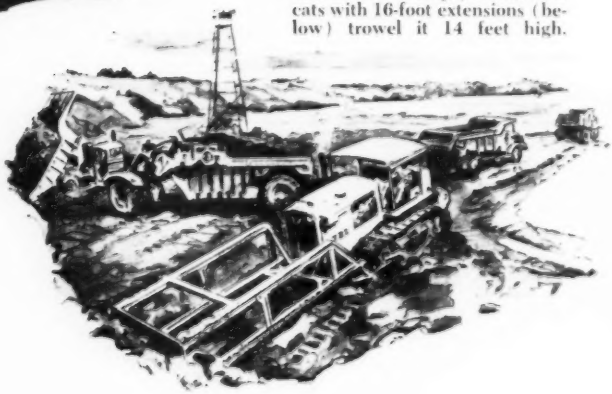


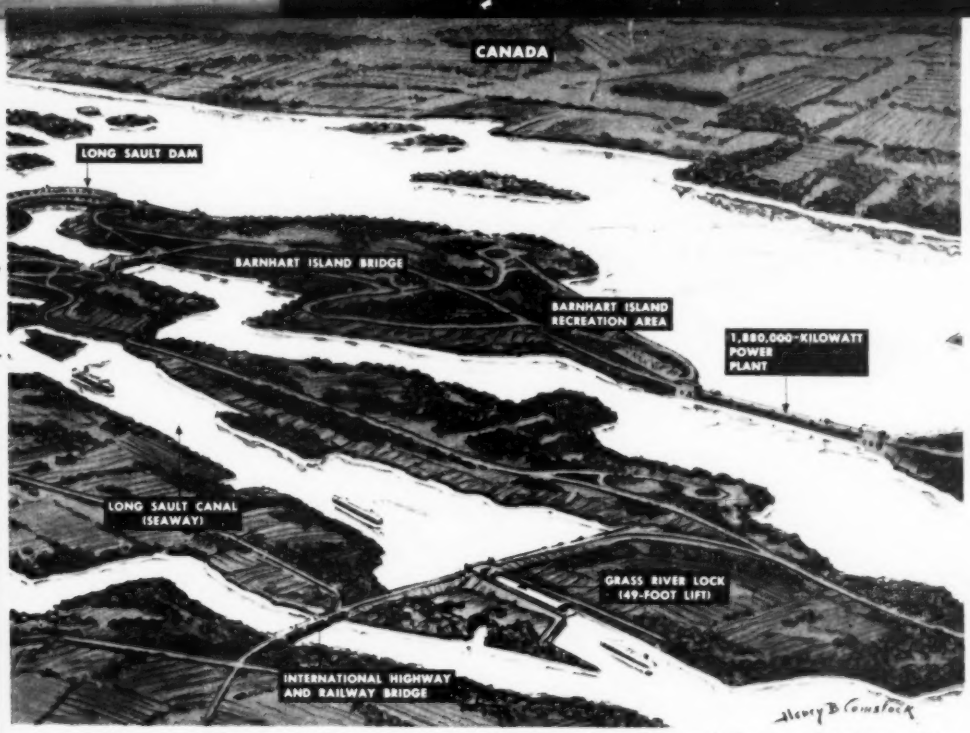
Some $70,000,000 will put this 12-mile

Armada

SIXTY FEET BELOW the surface of the present Cornwall Canal, four-yard shovels (above) clear a swath for the 3,200-foot-long Barnhart Island Powerhouse. Backed by a 30-mile lake; its 32 generators will develop 1,880,000 kilowatts. That's only 94,000 kilowatts less than the giant Grand Coulee turns out.

TOOTHPASTE-SOFT marine clay poses a special problem. Useless for dike construction, the muck is hauled away to giant inland waste heaps, where D-9 cats with 16-foot extensions (below) trowel it 14 feet high.





section near Massena, N.Y., to work, grinding out electricity and floating 8,000-ton ships.

# of Earth Movers Remakes a River

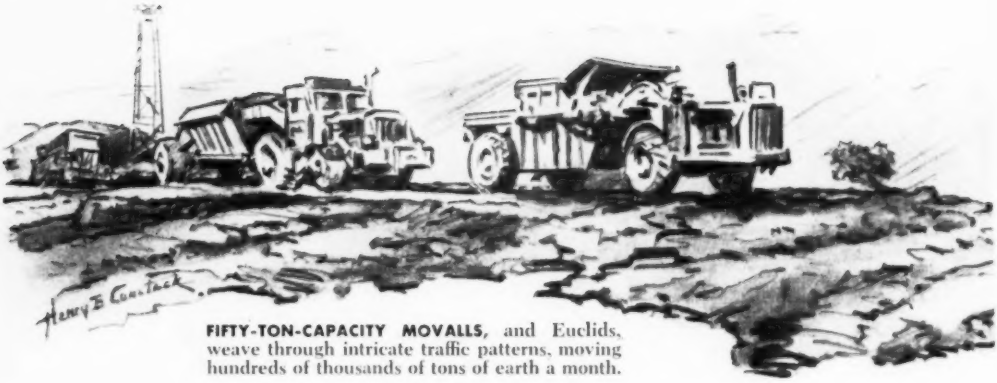
By Henry B. Comstock

ALONG one of the world's great international watercourses, between Montreal, Quebec, and Ogdensburg, N. Y., 6,000 Americans and Canadians are now carrying out one of the toughest jobs of plastic surgery ever performed on the face of the earth. Nearly 150 miles of island-studded rapids are being pushed around by the greatest armada of earth-moving gear ever used on one project. That project is the St. Lawrence Seaway and Power Installation.

Nearly 3,000 bulldozers, draglines, dredges, trucks and power shovels are working 20 hours a day. They will strip 180 million tons of dirt and rock from the valley floor within the next two years.

One hundred and eighty million tons is a lot of earth. If it were loaded in 50-ton gondola cars, the cars would fill a train yard 75 tracks wide, extending from Montreal to Buffalo—360 miles.

Clawed and whittled. But that's only half the story. Much of this earth must be clawed from a river bottom over which 340,000 cubic feet of water a second boil along at speeds up to 18 miles per hour. More millions of tons must be whittled from rugged outcroppings of dolomite to form straightaways for the Seaway's 450-foot-wide, 27-foot-deep channel. Behind miles of steel-faced cofferdams, other pits are being cleared 115 feet down to bedrock for three giant



FIFTY-TON-CAPACITY MOVALLS, and Euclids, weave through intricate traffic patterns, moving hundreds of thousands of tons of earth a month.

dams and a powerhouse that will grind out more kilowatts than all of the hydroelectric plants in the Tennessee Valley Authority put together.

Floundering in and out of these excavations in a driving rain, with my sketchbook shielded under a hard hat that the Army Engineers at Massena, N. Y., had loaned to me for an inspection trip, may not have been the easiest way to see the Seaway. But it gave me a first-hand demonstration of the most impressive single feature of the project. That is the almost complete indifference of today's earth movers, and the men who run them, to any kind of weather.

I saw it best in a mile-long, pear-shaped pit that will soon be the east end of the Long Sault Canal. Here, behind an earth barrier from which a battery of 19 pumps was drawing nearly 2,000 gallons of infiltrating river water every minute, giant drag buckets were sinking their teeth into marine clay 80 feet below the surface.

The pushing mud. It would have been tricky business, even in dry weather. The blue-gray muck was so fluid that it developed 500-pounds' lateral thrust to the square foot at the bottom of the hole. That meant that the sides of the cut could rise no more than one vertical foot in 13 horizontal feet. Anything steeper would have caused a cave-in, engulfing equipment worth millions (a single truck may cost as much as $73,000).

You can't run 50-ton-capacity Movall dirt haulers over that kind of porridge, to say nothing of 200-ton cranes. So other trucks—little fellows that wouldn't damage ordinary highways—were scooting 12 miles upriver to pick up more stable fill. Returning, they dumped this heavy rubble in five-foot-thick ribbons on the marine clay, to form temporary roadways and platforms that would be shifted about as the work progressed.

All the sludge that came from this clay pit was worthless for the massive dike construction that was going on upstream. To haul it away to sprawling inland waste heaps, endless caravans of dromedary-humped Euclids and Movalls ground out of the pit, deliberately sluing from side to side to partly level out the deep ruts carved by their own eight-foot, cleated tires. D-9 cats—the largest dozers ever built—chased after them,

TEMPORARILY BLOCKED OFF from one channel (lower right), the St. Lawrence River surges at the rate of 340,000 cubic feet of water a second through a 750-foot jug-neck spanned by a cable-stayed pontoon bridge. Behind the cofferdam, bedrock is bared for the power plant.

dressing down the remaining hillocks, and now and then putting their steel shoulders to some mechanical monster wallowing helplessly in the gumbo.

In spite of a week of heavy rain, the buckets, dredges and shovels assigned to the U. S. and Canadian canal and power areas were clearing the equal of 2,800 ordinary house foundations every day.

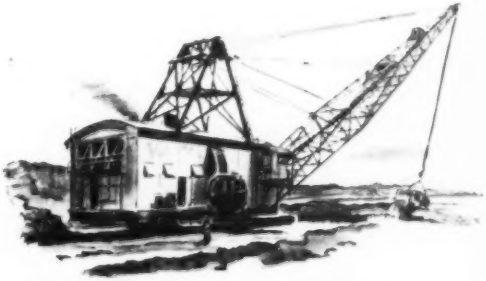
The "Gentleman." By the time you read this they will be doing better. Deep frosts will have stiffened the traffic routes and put substance into the pit sides. Other earth movers will have joined the fleet, among them a twin sister of the world's largest crawling dragline, the mighty "Gentleman."

Clawing away at the west end of the Long Sault Canal, the Gentleman has already made a bit of history. Until last March, this 650-ton, 10-story-high crane was working a bituminous mine in western Kentucky. When its owners, the Badgett Mine Stripping Corp., got the contract to remove 3,800,000 yards of earth for the long cut north of Massena, N. Y., the Gentleman and a smaller dragline were walked 19 miles overland to a tributary of the Green River.

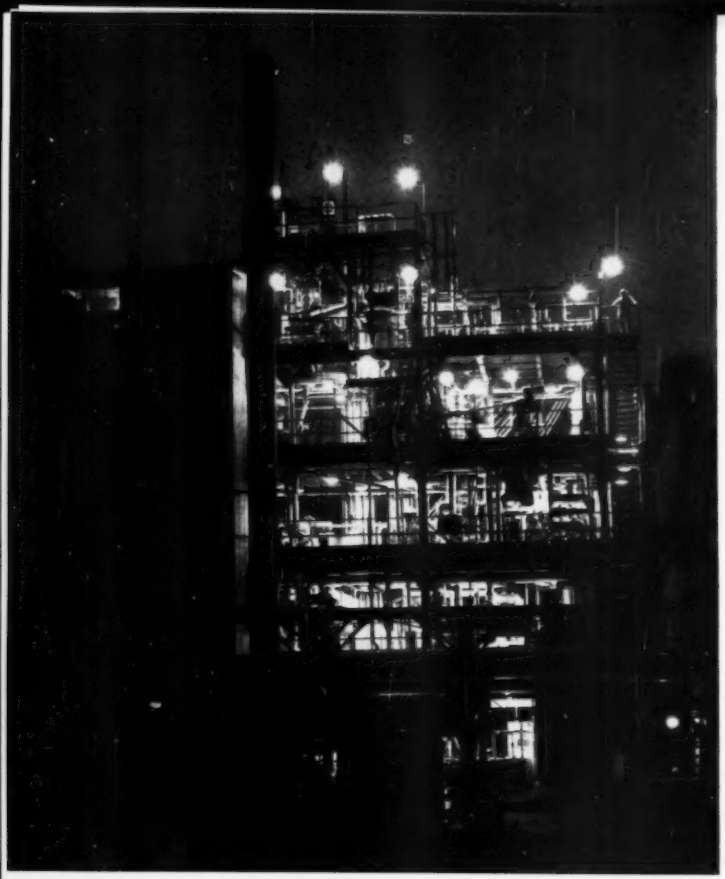
Much of the land was swampy and the cumbersome machines traversed it on cribs made from six-by-twelves, lifting one crib as soon as it was in the clear behind them and placing it out front for the next move.

Rapids and shoals. Loaded aboard a barge at last, the machines began a 2,200-mile inland voyage by way of the Ohio and Mississippi Rivers, the Illinois Ship Canal and the Great Lakes. When they entered the St. Lawrence rapids, hauled by two husky tugs and using their buckets as auxiliary brakes, experienced rivermen said they'd never run them safely. These predictions nearly came true—once when the barge rammed one of the tugs and sank her, and again when the current swept the cumbersome craft around the wrong side of an island, catapulting it over a couple of miles of shoals where there was never more than a foot of water to spare.

The Gentleman's owners admit that the huge rig has paid off for its 102-day trek. But they're looking forward to an easier trip home—via the Seaway. END



MEET THE "GENTLEMAN," biggest crawling dragline crane ever built. Since last July, the 900-hp. earth mover has torn out a million yards of dirt. Each scoop adds another 40 tons.



Automatic Factory Is Built Without Walls

A FACTORY that is open on all sides to wind, rain, snow and sleet has been set in operation at Parlin, N. J. It has no walls simply because it was cheaper to build that way, and walls aren't needed. The machinery is completely packaged and operation is automatic. A single control board monitors almost every phase of the factory's chemical-mixing processes.

Next to the plant is an enclosed, air-conditioned laboratory (at left in photo) where product-control tests will be run.

The open-air plant will manufacture a Du Pont polyester base for photographic film.

New Truck's Motor Pulls Out Like a Drawer

THE engine of a new frameless tank truck and trailer, built for the Pacific Intermountain Express by the Fruehauf Trailer Co., slides out of the front of the truck on rails like a file-cabinet drawer.

Fourteen quick disconnections and adjustments put the engine in its extended position for repairs.

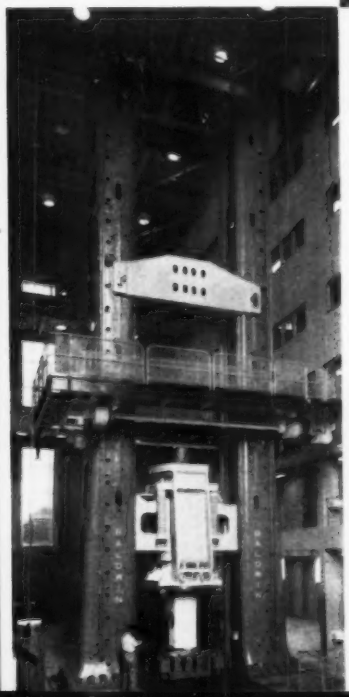
Engine, wheels and axles are built into the tank structure, and are supported by its framework.

New Detector Picks Up "Hot" Rays at Angle

To enable workers at the Hanford, Wash., Atomic Products Operation to remain longer in radioactive areas, General Electric has developed a wide-angle atomic-ray detector.

The new device monitors rays equally well from various directions. On older detectors these rays registered better when coming directly at the reactor; thus a safety factor had to be added in computing permissible time for such jobs as removing radioactive material with caustic steam, as in the photo at right.

GE scientists say, the wide-angled detector has increased production at Hanford.

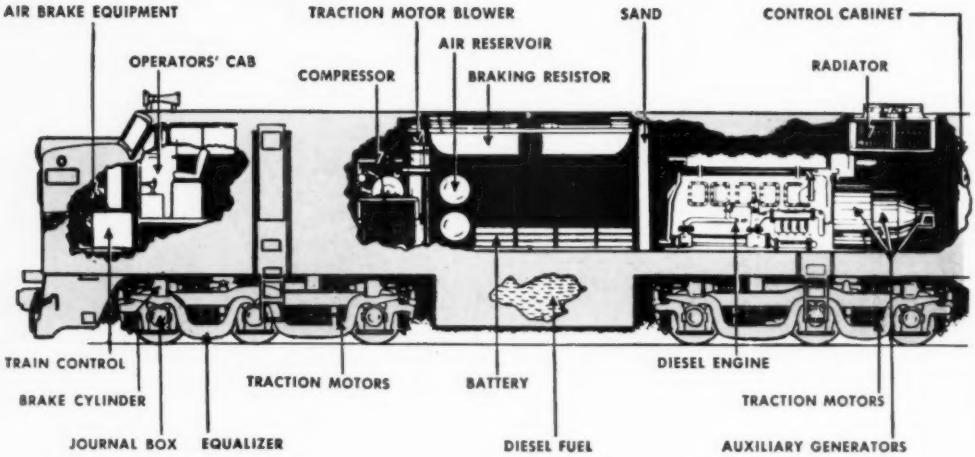


Giant Tester Flexes Steel Muscles at Lehigh

The machine at left, extending 60 feet above the test floor and 16 feet below, can apply tension and compression loads up to 2,500 tons. The world's largest device of its kind, it's in Lehigh University's new Fritz Engineering Laboratory.

Accordion Tarp Covers Flatcar Like Bellows

A built-in cover that slides on trolley tracks mounted on the car sides protects flatcar shipments on the Bessemer & Lake Erie Railroad. It's said to open or close in one minute.



Huge Gas Turbine to Drive

THE most powerful locomotive ever to pound U. S. rails will streak freight across the Union Pacific tracks in 1957. It will be the first of 15 giant gas-turbine engines—8,500 horsepower each—that General Electric is building for the U.P.

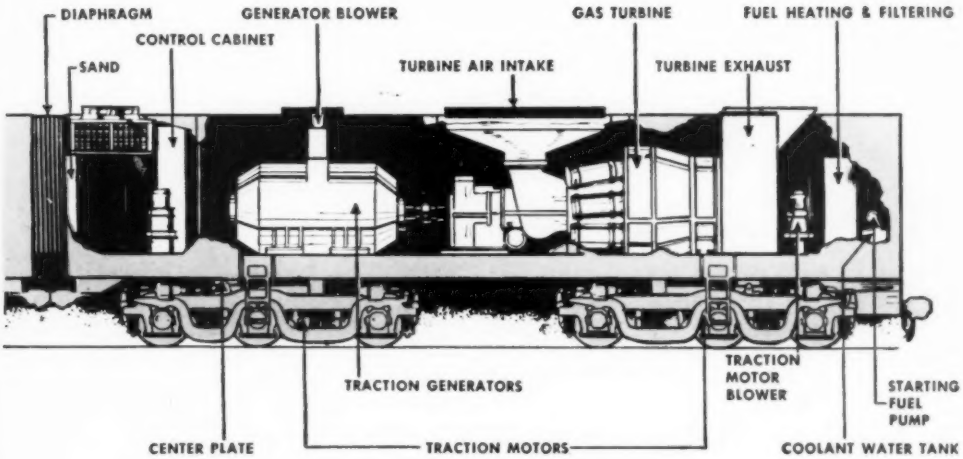
TWO-SECTION ENGINE will look like model above. Operators and diesel auxiliary are to ride up front. Rear will carry turbine, a model of which is held above by U.P.'s D. S. Neuhart.

The 119-foot locomotives will make 65 miles an hour with a long load of freight behind. They will weigh 408 tons each.

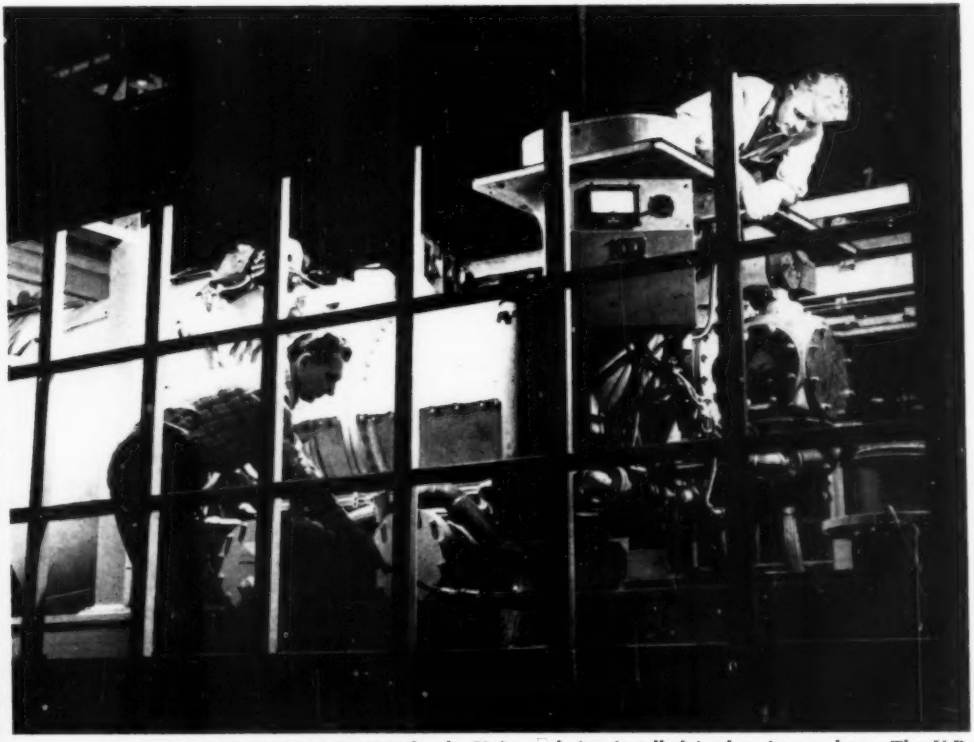
While using gas turbines for main power, these unusual engines will also carry their own independent diesel engines for auxiliary power. The diesel will operate accessories, crank the turbine for starting, and drive the locomotive around the yard.

Jets turn them. The huge engines will be similar to those that propel jet airplanes. They compress air, then spray fuel into the compressed air and burn the mixture, creating a powerful jet of hot gases. The jet will not propel the engine directly, as it does airplanes, but will drive turbines connected to electric generators. The electricity will spin motors at each wheel.

The Union Pacific's new turbine engines will be more powerful even than the proposed atomic locomotive X-12 (7,200 hp. estimated). It easily outranks existing giant engines in the United States: the U.P.'s own Big Boy coal steamer (6,670 hp.), the Virginian's two-unit electric (6,800 hp.), and the General Motors F-7 four-unit diesel (6,000 hp.). Some Swiss electric locomotives turn up still more power, however.

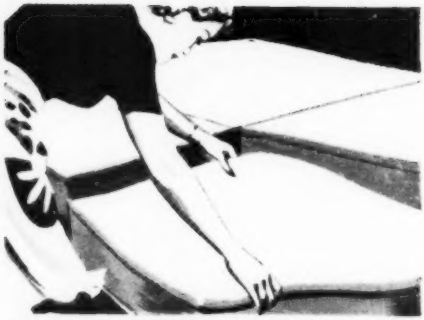


Most Powerful Locomotive

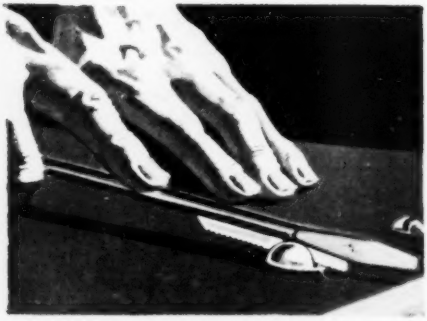


TURBINES ALREADY HAUL FREIGHT for the Union Pacific. They are 4,500-hp. units like the one being installed in the picture above. The U.P. now operates 25 of these engines. END

I'd Like to see them make...



A SECTIONAL MATTRESS made in four parts and zippered together, so that one person could handle it easily to move, shift, store or clean it.—*Mrs. Ann Dickinson, Buena Vista, Ga.*



A SCREWDRIVER WITH HACKSAW BLADE built into one side of the stem. Then if a screw slot were worn or damaged, it could be trued up with the blade.—*J. R. Miles, Newport, R. I.*

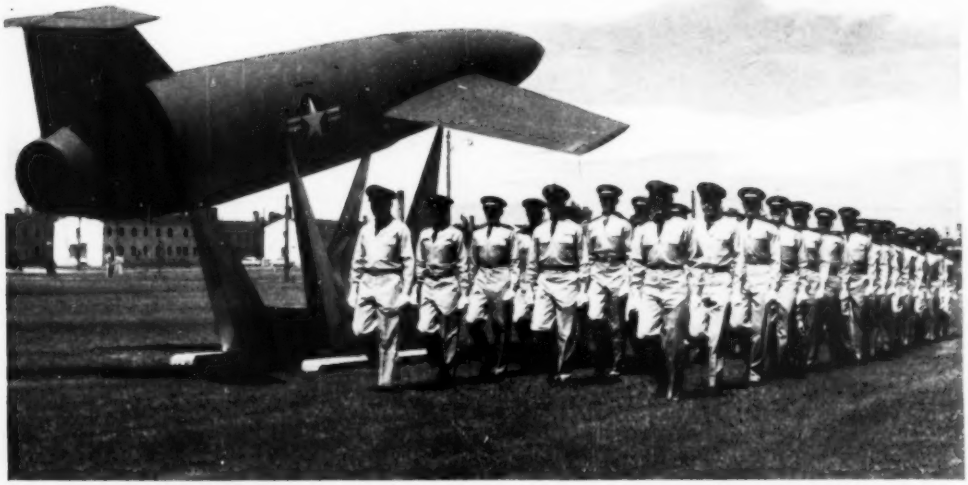
BABY CARRIAGE STANDS to prevent buggies from toppling when youngsters stand up. They would have to fold up or telescope when not in use.—*T. J. Holmes, Farmingdale, N. Y.*

A PADDED HAT FOR MECHANICS who work on their backs under cars. It could be made like a cap or a helmet with foam rubber padding at the back.—*V. E. Hoffman Jr., Corning, N. Y.*

LIQUEFIED ASBESTOS in handy pressurized cans for spraying on heating pipes, water pipes, above furnaces and around hot-air registers.—*Nathan Bridwell, Midland, Ind.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What is *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

Training Tomorrow's Air Force Generals



ON DRESS PARADE, cadets march past the red shell of a Matador pilotless bomber on their present campus. They range from five feet four to six feet four, with weight scaled to height.

Here at the new Air Academy in Denver, 300 rugged youngsters take stubborn aim on the stars.

By Wesley S. Griswold

OUT in Denver, "a mile nearer the sun," there is a brand-new college for men where education is free. Housing and expert medical care are thrown in. Every new student's travel expenses from his home to the college are paid for him. Once there, he is given an allowance for food and paid $111.15 a month for four years.

This alluring route to a college degree is, however, a terribly rough road. Just to set one's feet on it involves running a physical and scholastic gantlet that knocks out 95 percent of the contestants. Of 6,437 candidates for the first class, now in mid-term, only 306 won out.

This fledgling school, to which so few are going to owe so much, is the U.S. Air

THIS HUGE WOODEN MOCK-UP of an astrocompass works realistically. It is one of many training aids, built in the Academy workshop, that acquaint cadets with navigation instruments.

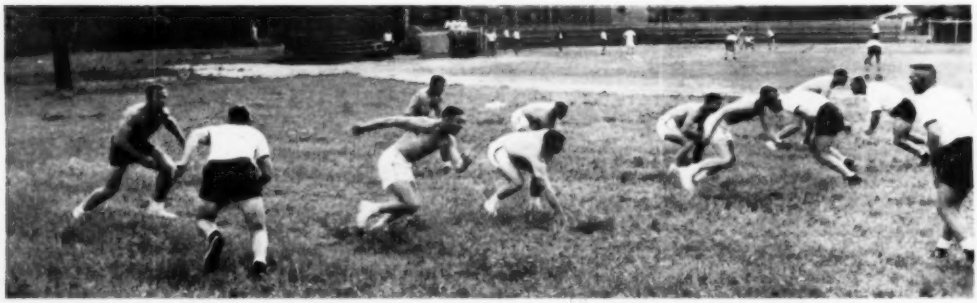
FLYING CLASSROOM: This is one of the planes that the Academy uses for navigation training. Equipment includes radarscopes, loran indicators, radios and dead-reckoning instruments.

Force Academy. Here is where the future generals of the Air Force are being trained. That is what the cadets are frequently told, and that is what they are determined to be.

Deadline. The Academy opened last July. All applications for the 300 places in the second class, which enters the Academy next July, must be in Washington by midnight of Jan. 31—this month. Yet, three and a half months ago there were already two candidates for every available space.

The boys, between 17 and 22, who cleared all obstacles to membership in the historic first class could be forgiven if they regarded themselves as an elite group. Nearly half of them had won scholastic honors in previous schools. Among them were 31 former class presidents and many a touted high-school athlete.

To get into the Academy they first had to earn nominations, then pass a medical exam for flight training, Air Force pilot-aptitude and observer-aptitude tests, and College Board entrance exams. Even after taking those formidable hurdles, 2,960 candidates were still in the running. Stiffer, state-wide competitions finally weeded out all but the select few who are now working their heads off in a



EVERY CADET MUST PLAY some sport. If he's not on an intercollegiate team, then he must be on an intramural team. But the boys take to sports eagerly, as seen here on an Academy picnic.

corner of Lowry Air Force Base, in buildings and barracks inherited from a former guided-missile training center.

Future quarters. Sometime in 1958, the Air Force Academy is scheduled to move to permanent quarters near Colorado Springs. With a cadet corps expanded to 2,496, it will then occupy a $125,000,000 layout of ultramodern buildings and equipment on a 17,500-acre reservation lying against the piney, crumpled foothills of the Rockies.

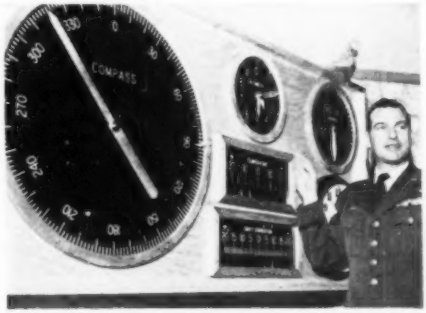
Today's Academy cadet, despite his present plain surroundings, is imbued with an exhilarating sense of destiny. He needs it to keep his morale high through the bracing, the double-time pace enforced for every errand in the cadet area, the constant threat of demerits, the restrictions that hem him in, the heavy load of studies, the unscheduled classroom quizzes, the relentless competition, and the all-too-limited time to prepare for the next day's lessons. Many cadets regularly get up to study for an hour before Reveille, which a bugler sounds at 5:50 a.m. Frequently they arrange to keep their lights on for an hour's cramming after Taps, at 9:30 p.m.

For character guidance—ATO's. Whenever they are not sleeping or studying or engaged in sports or at their classes (limited to 16), cadets must contend with ATO's. The ATO's (Air Training Officers) are first and second lieutenants—a few West Pointers, a few more Annapolis men, but mostly ROTC officers from civilian colleges and graduates of aviation-cadet schools. They are responsible for the Academy cadets' military training and character guidance. They also substitute for upperclassmen, putting the callow cadets through an intermittent course of disciplining that bristles with potential demerits and punishments.

The gadfly approach of the ATO's to the cadets at moments when the lads might tend to relax is not based on a mere urge to annoy. Cadets must learn to control their tempers and think quickly under the most trying circumstances. Their memories must be stretched to the utmost and given constant exercise to

IN CASE OF SUDDEN EMERGENCY in flight in an Academy navigation-training plane, cadets would release the astrodomes to escape. This cadet learns by practicing on classroom model.

A CLASS IN CHEMISTRY, in the Academy's outstandingly well-equipped lab, inspects an analytical balance, which is delicate enough to register the weight of a half-inch pencil mark.



PROBLEMS IN NAVIGATION are worked out for and by cadets before actual flight. This is a mock-up of the instruments they will need to consult to figure out necessary drift correction.

cope with the load of instruction steadily being heaped upon them. Consequently, the ATO's give them long and generally uplifting quotations from military leaders to memorize, and they are required to be letter-perfect when suddenly called upon to stand at attention and repeat them—preferably at an awkward time and place.

A special language. At the insistence of the ATO's, also, every cadet must rapidly learn a language entirely new to most of them—the jargon of pilot-to-tower and intercom conversation.

Legs are "wheels" or "gear." Arms are "flaps." A dining table is a "ramp." Walking is "taxiing." "Blast off" is the equivalent of "beat it." A coach or an instructor is "the tower." A pitcher of milk on its way to or from the kitchen is on "cross country." Water is "fuel injection." The kitchen is the "hangar." The word "notam," meaning "notice to airmen," is used to apply to any announcement of general interest.

LETHAL ART OF SELF-DEFENSE—judo—is an unusual item in the physical-training program for Air Force cadets. Guns are wooden; blunt knives and bayonets are aluminum.

At every meal cadets are assigned, in rotation, to the roles of navigator, crew chief, hot pilot and cold pilot. The navigator calls a waiter by raising his right hand. He also announces the menu and proclaims the arrival of the various items of food. "Sir, the fuel injection has met its ETA and is on the ramp" means, for instance, that the water has arrived on time and is on the table. The "sir" addressed is an ATO, who, as the ranking man present, must always be served first. The hot pilot distributes hot drinks, the cold pilot cold drinks. It is the crew chief's job to stack the dishes after the crew is through with them.

Mess-hall medley. Each meal commences in theatrical silence. The cadets stand rigidly at attention at their places, chins drawn back against Adam's apples, eyes staring unseeingly into the eyes of fellow cadets across the tables. At a sharp command, they seat themselves. Immediately there is an explosion of voices—not the cheerful roar of laughter and eager conversations but the tense sound of scores of urgent recitations, pitched loud and high in the attempt to drown out all conflicting noises. These are the navigators making their announcements.

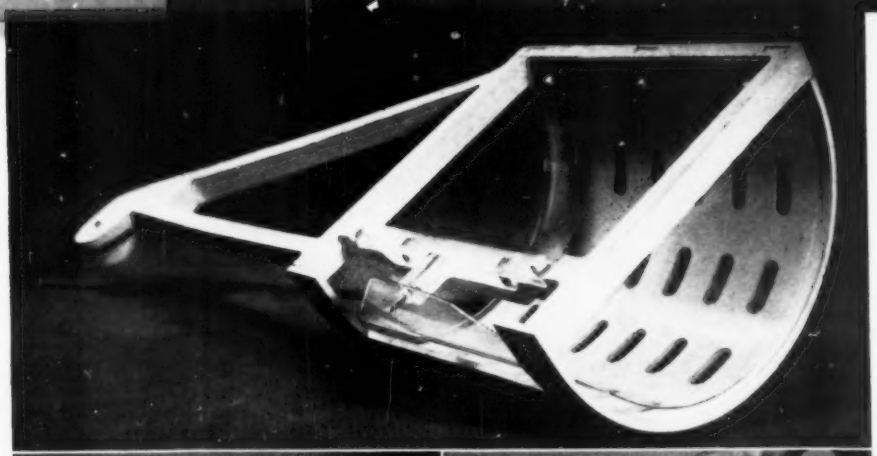
The terse, colorful jargon of the mess hall is also heard on the playing fields. "Take-off position" is a proper stance. "Take runway" means "line up" or "get into position." A "hot start" in football is one in which one or more players are off side, or the backs are in motion. "Put down flaps" means "slow up."

Jargon with a purpose. What to a fresh cadet at first seems nonsense and an irritating extension of the bracing process has a very serious purpose, though, Academy officials say. Some day these cadets will be flying officers. Complete familiarity with this special language will then be vital to their instant comprehension of instructions from a control tower and to the clarity of their orders to a crew.

Practically every cadet at the Air Force Academy yearns to be a pilot—yet none will learn to fly there. In his four years as an undergraduate, each man will be given just 15 hours of light-plane pilot training—merely enough to acquaint him with the essential reactions and physical problems of a pilot. He'll do a lot of flying, but almost all of it will be in the process of learning to be an aerial navigator.

This training, if he completes it successfully, will entitle him to the wings

[*Continued on page 282*]



Fifty-Cent Phonograph May Pierce Iron Curtain

A NEW weapon for sending messages behind the Iron Curtain without danger of radio jamming has been offered to the U. S. by RCA. It's a refinement of the basic hand phonograph and could be mass-produced for 50 cents each.

The little machine is in three unbreakable plastic parts—base, turntable and tone arm—and can be packed to drop by parachute.

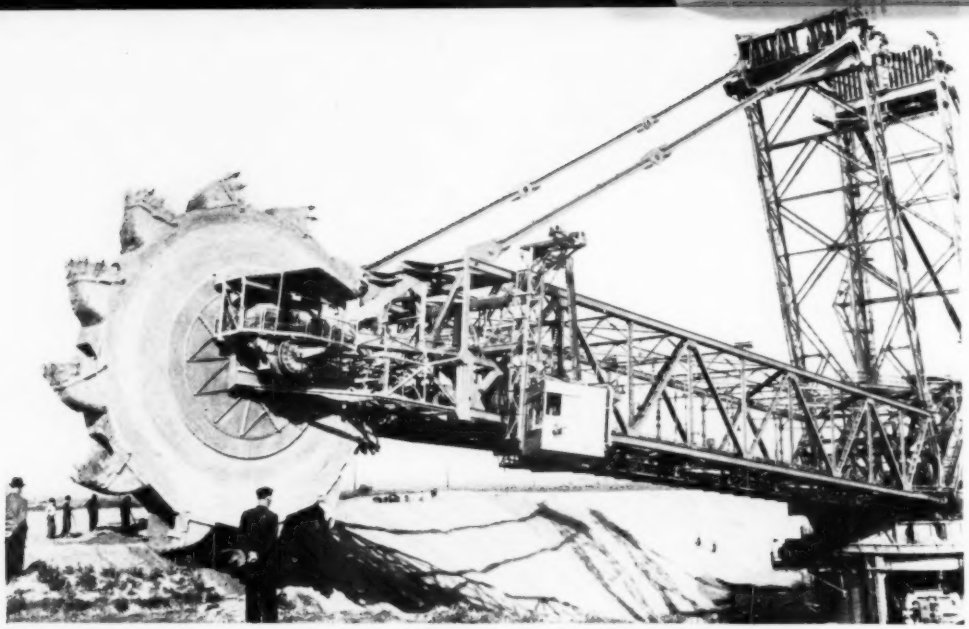
Heart of the design is a clear-plastic semi-circular vibrator screwed inside the top end of a guard. A plastic cube cemented on takes the needle in a force fit. RCA designers say that they get best results from a common steel needle of the long-playing kind. A metal crank spins the table.

Records are 78-r.p.m. unbreakable-plastic seven-inchers costing five cents, but the arm can take a 10-inch record. The speed, common in Europe, is easy for hand turning.

3-D Projector Turns Aerial Photos into Maps

TRANSPARENCIES made from aerial photographs are projected in 3-D on the table of the machine at left. Survey maps can thus be plotted with contour intervals as close as one or two feet.

A map maker, viewing the picture from the two overhead projectors through special stereo glasses, adjusts a precision tracing instrument which records ground surface at a particular level and produces one contour line. The instrument is readjusted for each succeeding line. Bausch & Lomb incorporates in the design a special reflector developed by the U. S. Geological Survey.



12-Jawed Dredging Machine Scoops Up Soil in Giant Mouthfuls

THIS huge mine dredger—largest of its kind in the world—gnaws insatiably into the earth with its multi-jawed wheel at the lignite pits in Auenheim, Germany. Built by two German firms at a cost of $5,000,000, it is 656 feet long, weighs 5,500 tons and is powered by 116 electric motors. The bite of its 52-foot-diameter wheel is controlled from the cabin on the side of the crane. Dirt is carried way on a conveyor belt.

Modern Art Decorates Modern Homes

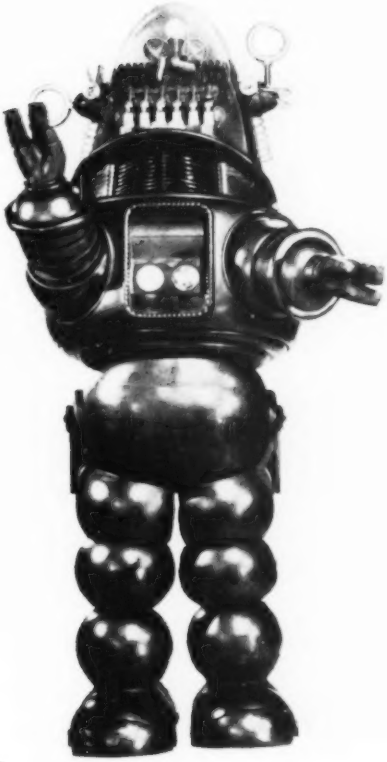
LATEST in swank for fashionable apartment houses in Caracas, Venezuela, is this colorful mosaic. It rises 50 feet high on a pink background that is inlaid with scatter tones of blue, red, yellow and black.

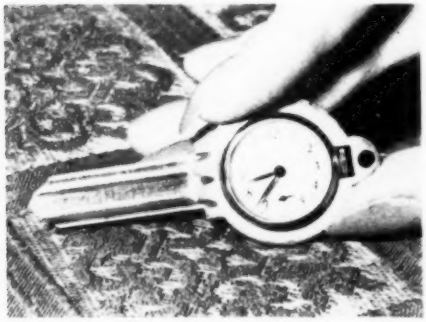
Owners of the apartment paid Prof. Ennio Tamiazzo, Venetian artist, 40,000 bolivars (about $12,000) for the massive work.

The apartment, built at a cost of 1,300,000 bolivars, stands on huge stilts to increase the garden area.

Here's a Servant Out of This World

A SEVEN-FOOT eight-inch robot does its master's bidding in M-G-M's new movie, "Forbidden Planet." Made of plastic and synthetic leather, the robot is animated by electricity. Ears are rotating antennas, and its grillework mouth hides a loudspeaker.





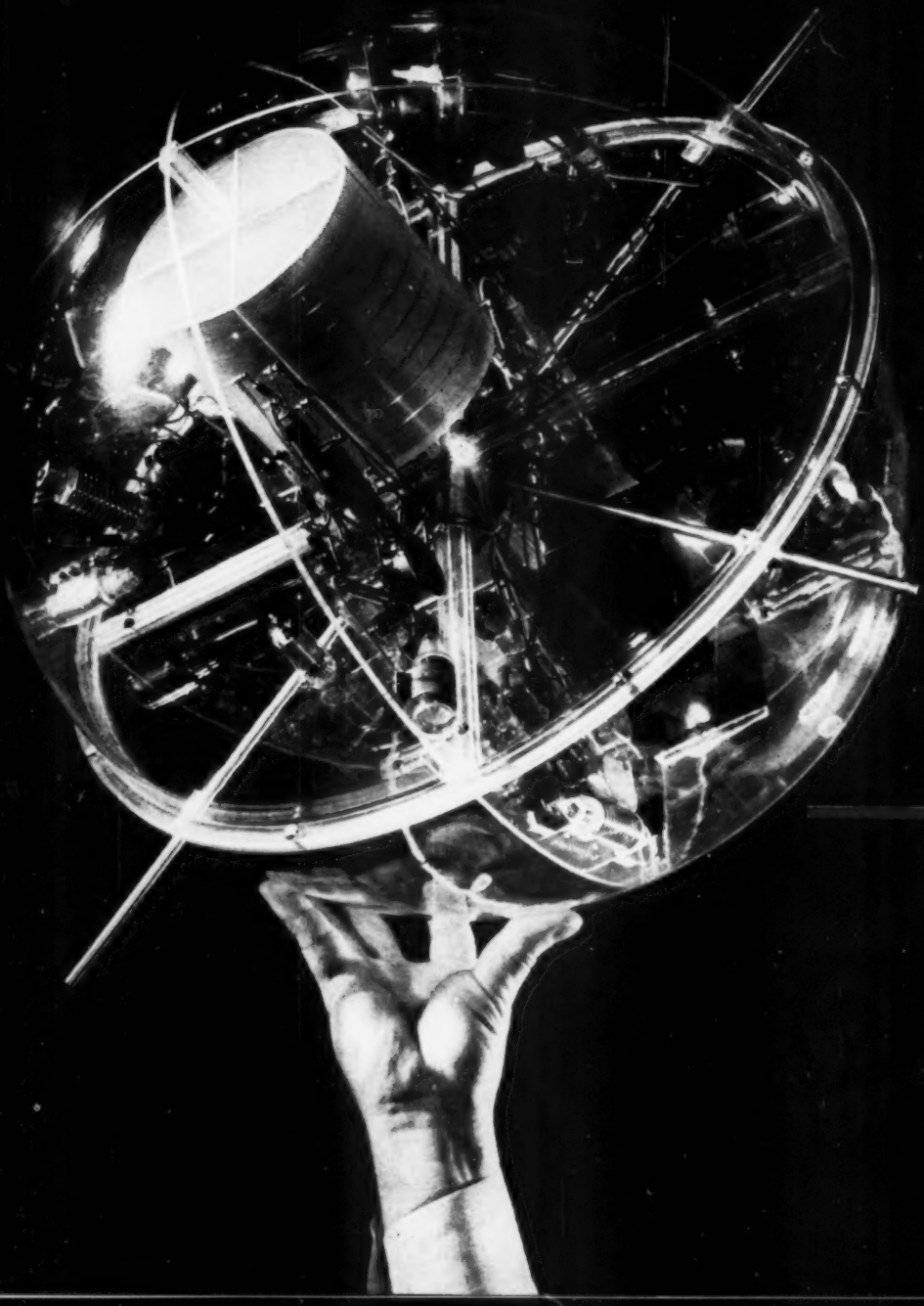
Novel Latchkey Tells Time, Too

ONE way to remind yourself when it's time to go home is to have your watch set in your latchkey. The combination above was shown in an exhibit of "Five Centuries of British Timekeeping" by London watchmakers.

Self-Propelled Big Gun Gives Army Agile Antitank Fire Power

RIDING atop a light tanklike body, the Army's new T-101 is a highly mobile 90-mm. gun that can hit and run hard over mud, marsh, sand or snow. Designed as a powerful antitank weapon, it is light enough to be dropped in airborne assaults. It carries a crew of three and is powered by a six-cylinder, 205-hp. engine. Speed: 30 m.p.h.

Plastic Moon



to Circle Earth 16 Times a Day

Here is the inside story of what the world's first artificial satellites may look like—and the jobs they may do in space.

By Herbert O. Johansen

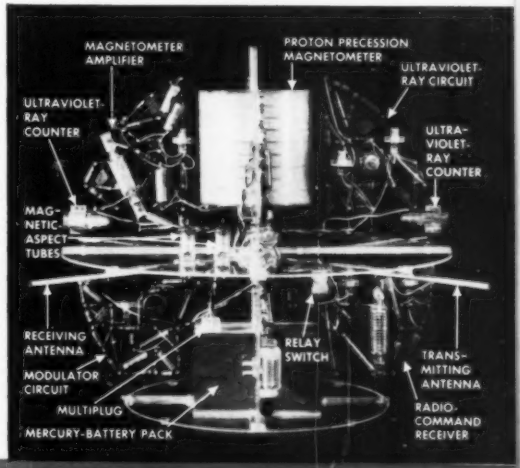
PHOTOS, INCLUDING COVER, BY HUBERT LUCKETT

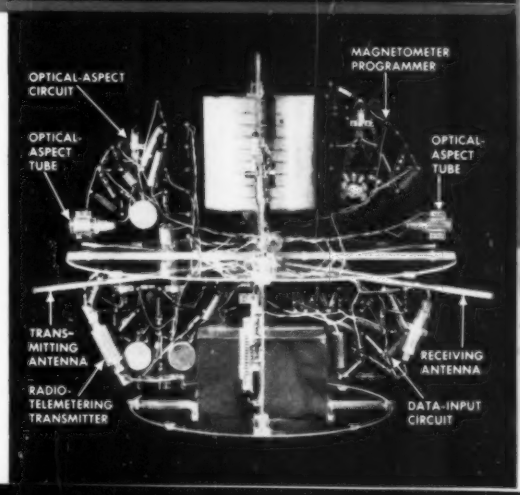
SOME day within the next two years, as you look toward the horizon in the darkness before dawn or after dusk, you may see a faint spot of light moving swiftly across a moonless, star-studded sky. It will be man's first milestone in space—an artificial satellite, an earth-born baby moon shining with reflected light from the sun.

It will not be as spectacular as an atom-bomb burst. But it will be one of the greatest scientific achievements in the history of mankind. And it will inspire awe, because that dot of light in the sky will mean that the world's mightiest rocket combinations have been fired for the peaceful purpose of learning more about the universe.

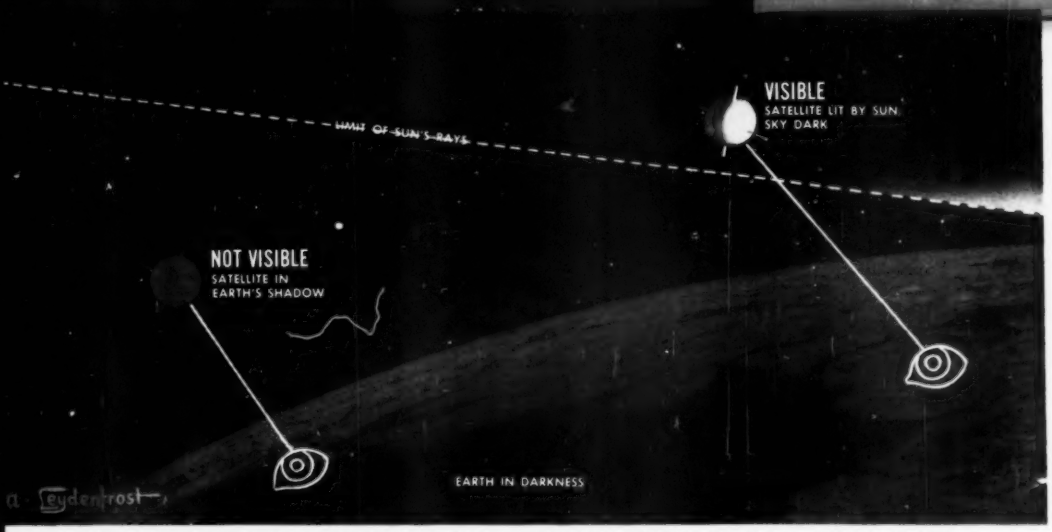
The United States plans to launch 10 such satellites between July 1957 and December 1958. They are expected to cost about $10,000,000. This will be part of our country's contribution to research that is being undertaken by 40 countries, cooperatively, during the International Geophysical Year (IGY).

Boosting the "bird." The Defense Department will attempt to get the satellites into their orbits, at speeds close to





MODEL SHOWS THE BIRD'S WORKS: Herbert R. Pfister, associate editor of POPULAR SCIENCE MONTHLY, built the model of a satellite shown here after consulting scientists associated with the U.S. National Committee for the International Geophysical Year (IGY). He used standard subminiature electronic parts to simulate instrumentation such as will be used to examine space and radio the findings back to earth. The chassis drops into one half of the ball and is locked in place by attaching the other half. Parts used to build this 25-pound plastic model, 18 inches in diameter, cost $150. Assembly took one month. Mr. Pfister has built sibling satellites for New York's Hayden Planetarium and the IGY Committee's Washington offices.



WILL YOU BE ABLE TO SEE A SATELLITE? Scientists say yes. Like our big moon, the little man-made one will have no light of its own, but will shine by reflecting the light from the sun. Under the right viewing conditions (shown in the drawing above) even a small satellite is expected to have the brightness of a fifth-magnitude star, the faintest star that is visible to the

18,000 miles per hour, as part of its Operation Vanguard. Three-stage rockets will be used to do this. The first, or launching part, of each rocket will be a special Martin Viking with a new and more powerful engine that General Electric is now building. This engine probably will be built of new, light, strong alloys, and use new and more efficient fuel combinations, to save weight.

The payloads—the actual satellites—probably will be designed and built at the Naval Research Laboratory, where electronic heads for sounding rockets such as the Deacon already have been constructed.

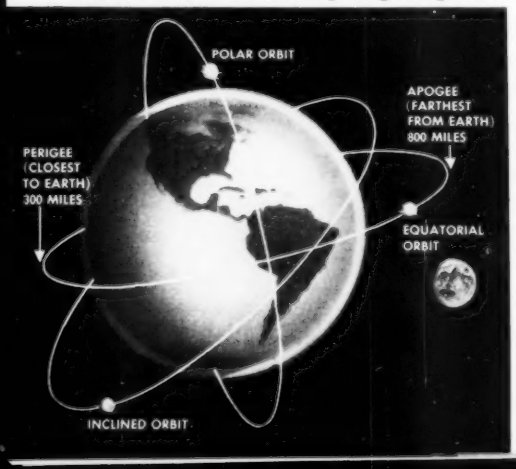
What will these satellites look like? What will go inside them? What will they do up there in space?

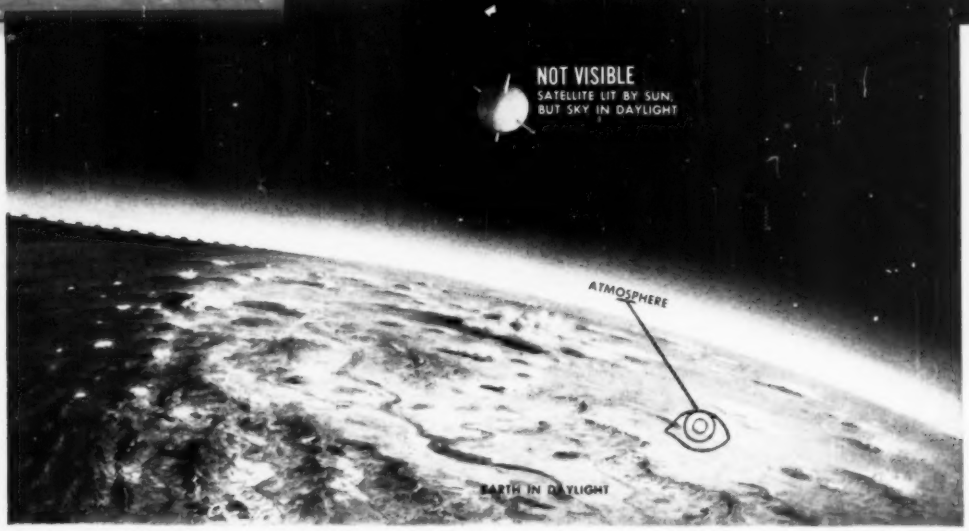
Since the first one has not yet been built, not even the experts can say exactly. But high-altitude rockets such as Vikings, Aerobees, two-stage Bumpers, and balloon-launched Deacons, have been packed with electronic research instruments and sent aloft repeatedly, as high as 242 miles, for a few minutes of space flight. They have successfully radio-telemetered their findings back to earth. Similar construction techniques and electronic instruments will go into the satellites.

The known factors. A great deal of paper work has been done, of course, on the design of artificial satellites, such as the now-famous MOUSE (PSM, Aug. '54, p. 72). Also, there are specific, known physical limitations and scientific requirements for any satellite that is to get up into an orbit and circle the earth for any length of time.

These known factors have been interpreted for POPULAR SCIENCE MONTHLY by members of the U.S. National Com-

A SATELLITE'S ASSIGNED SPACE-RESEARCH JOB and the desired path of visibility from the earth will determine the type of orbit into which any one "bird" may be launched. All of the orbits will be elliptical in shape. A satellite that is ejected at 300 miles above the earth, for instance, might swing out as far as 800 miles at the other end of its globe-girdling track.





keen naked eye. To be seen, such an object must be illuminated by the sun's rays while the sky, or atmosphere, above the observer is black. It must be in the daylight while you are in the dark—that is, before sunrise or after dusk. Where, how often, and when you will be able to see the artificial satellite will depend upon the orbit into which it is launched.

mittee for the International Geophysical Year. These scientists are working intensively on the satellite program. Thus, we can venture an educated guess as to the size, the shape, the weight and the contents of the first artificial baby moon:

Size. This will depend to a great extent on the nose diameter of the third-stage rocket that will give the satellite its final boost into space and kick it off at the necessary orbital speed. A diameter of between 14 and 20 inches appears likely. If the satellite were too small, it would not be able to carry instrumentation, and might not even be "visible" for tracking by special optical and radio-finding devices.

If it proves desirable to use a sphere that is too large to go inside the nose of the top rocket, one solution has been suggested: It could sit, like an egg in an eggcup, on the truncated nose of the rocket, attached to it by an explosive bolt. At burnout time of the rocket, an electric charge would blow the bolt apart, releasing a spring to kick the satellite free like a jack-in-the-box. To give the sphere protection and an aerodynamic shape for the ride up, it might be fitted with a sort of dunce-cap cover.

Shape. A sphere is scientifically desirable. It always presents the same shape of surface in the direction of forward movement, no matter how it may spin or turn—an important factor to scientists who will be measuring the air-drag on the satellite to obtain accurate data about the density of the air at high altitudes. This information may affect the design of tomorrow's extremely high-flying aircraft, and of future manned space vehicles.

A sphere would also eliminate tumbling that might be characteristic of other shapes, such as a cylinder. A tendency to do that would interfere with radio-telemetering of data from the satellite to the ground. Again, however, the space available for a satellite in the third-stage rocket will undoubtedly influence the shape.

Materials. The shell will have to be light, and therefore thin, but strengthened by internal bracing. Aluminum is generally favored. One of the important studies proposed, however, is an investigation of unknown electric currents flowing in and beyond the ionosphere. This could be done with a magnetometer, but the shell of the satellite used for this project should be both nonmagnetic and nonconductive. That rules out aluminum and other alloys, and suggests that plastic will be used for at least one of the birds

INSTRUMENT-PACKED CHASSIS of satellite model lifts out of its plastic shell. This type of construction in the real satellites would simplify testing of circuits and instruments during experimental, laboratory stages. Spreading of the circuits, as in this model, would prevent overheating when the juice was turned on. In the foreground are removable plastic antennas.

—probably of a milky color that would reflect and diffuse sunlight for greater visibility.

Weight. This is something about which there will be no doubt once the rocket men know the power and performance of the rocket-launching system to be used.

The third stage, to reach an orbital altitude of, say, 300 miles, and an orbital speed of 18,000 miles an hour, will have a definite top weight limit. From this, subtract the weight of the third-stage rocket itself and its fuel, and you have the maximum weight of your satellite. One extra pound of satellite would require 300 extra pounds of rocket fuel. Based on what can be done with existing rocket techniques, a good guess is that each satellite will weigh about 30 pounds.

Inside the satellite. Each bird will carry instruments for scientific research. Since there will be no attempt to recover the satellites or their instruments before they descend into the dense lower atmosphere where they will be destroyed, or will burn up like shooting stars, provision must be made for a radio-telemetering unit in each one to transmit information to ground stations.

Such a transmitter, as well as the electronic research instruments, will require a power supply. Mercury batteries have been suggested because they give the best energy for weight and have an excellent shelf life (minimum loss of energy when not being used).

Solar batteries are not being considered at present. One reason is that they are still too new: They haven't the proven reliability and performance that the scientists want for all of the satellite's components.

Ground signals. Any battery weight allowable for a satellite would not supply power enough for even one day of full-time operation of the various circuits. So, to conserve power, the circuits will be turned on by radio signals from the ground for short periods only, when the satellite is in the best position in its orbit to obtain and transmit information. This calls for a radio-command receiver in the satellite. Consuming perhaps one-quarter of a watt, it will be on a constant alert to pick up a ground signal that will either energize the filaments and tubes, or turn them off.

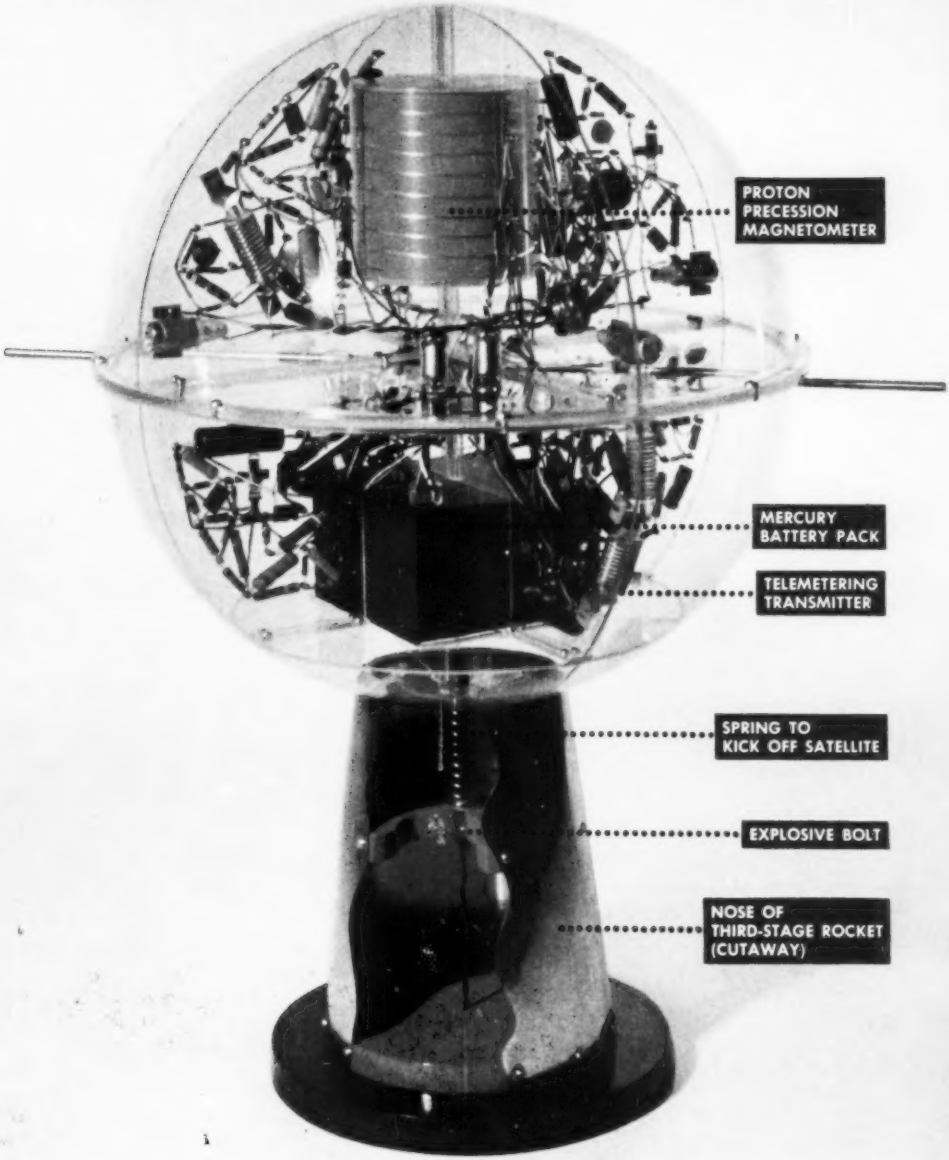
In a 30-pound satellite, it is estimated that current from a power pack of maximum weight, turned on for five minutes during each of the satellite's 16 daily passages around its 90-minute orbit, could operate the instruments and transmitter over a period of 15 days. This is the probable length of time that a satellite orbiting at a 200-mile altitude would stay up.

Up to 300 miles. There is good reason to believe that satellites will be put into their orbits at varying altitudes above that, up to 300 miles. A satellite at 300 miles is expected to remain in its orbit for as long as a year.

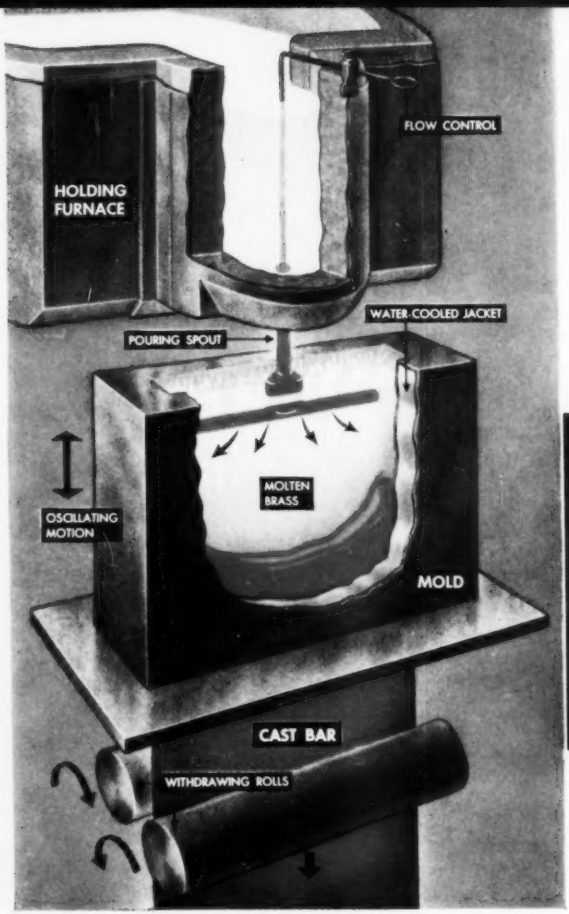
Although it could not collect information and radio it back for more than 15 days, it would still be a useful object in space. Observers on the ground could track it with radio and optical devices to continue air-drag studies. And by triangulation—observation from several ground stations simultaneously—it could be used for geodetic studies, to give us more exact knowledge of the size and shape of the earth.

[*Continued on page 268*]

Popular Science Monthly's Satellite Model Mounted for Public Display

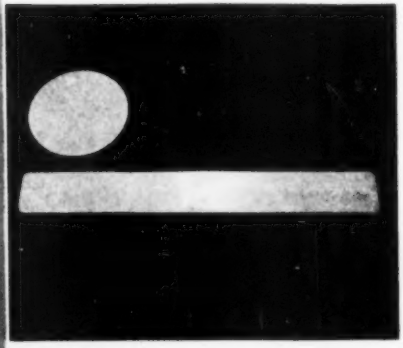


MODEL OF ARTIFICIAL SATELLITE stands on truncated third-stage rocket, as bird might in actual flight. For launching, the satellite would be attached to the top of the rocket by an explosive bolt. When the rocket burned out at orbital altitude, an electric current would explode the bolt, releasing a spring to kick the satellite out like a jack-in-the-box. To give it an aerodynamic shape, the satellite probably would wear a dunce-cap-like headgear.



Casting

HERE'S PRINCIPLE of continuous brass casting. Molten metal enters water-cooled mold at top. Cooled and solidified metal emerges at bottom, where rolls draw it downward. This mold makes rectangular "bar." Another makes round "billet."

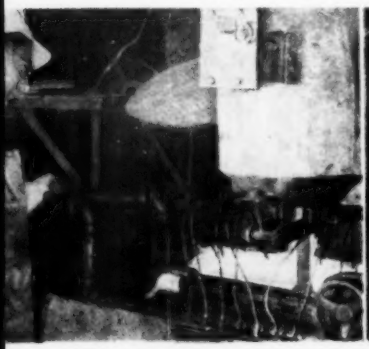


SAMPLES above compare shapes of castings. Rectangular bars, 26½ inches wide, 3¼ inches thick, yield brass sheet and narrower "strip." Round 7¾-inch-diameter billets become rods, wire, tubes. Flowery etched patterns tell expert: "Highest quality."

WATER-COOLED MOLD (photo and diagram) casts an endless brass bar. Mold slowly oscillates, sliding upward along solidifying bar, then descending with it. Tiny pipes (photo) squirt sperm oil into the mold to lubricate its copper lining.

AS HOT BAR of solid brass descends from mold, traveling saw carriage clamps to it, and this circular saw cuts off 10-foot, 3,000-pound lengths for the cold-rolling mill. The color of the metal, at this stage, is hidden by surface oxides.

CUT-OFF LENGTH drops into cradle, is lowered flat, and coasts out on rollers to be numbered, as above, on way to the stockpile. At lunchtime, worker may cook steak on hot bar. Later a milling machine will smooth and clean the bar's surface.



Brass Bars by the Mile

A RIVER of solid brass flows from a four-story-high machine at Waterbury, Conn. The modern miracle of continuous casting, applied here on full industrial scale, turns molten metal into an endless bar. Cut-off lengths of 3,000 pounds each, the industry's biggest, feed a great rolling mill more than a quarter-mile long. A companion machine similarly casts an endless round brass billet. Pictured at the plant of the Scovill Manufacturing Co., the continuous-casting process yields superbly sound and uniform brass, for the myriad of useful and decorative articles that are fashioned from the handsome metal today.

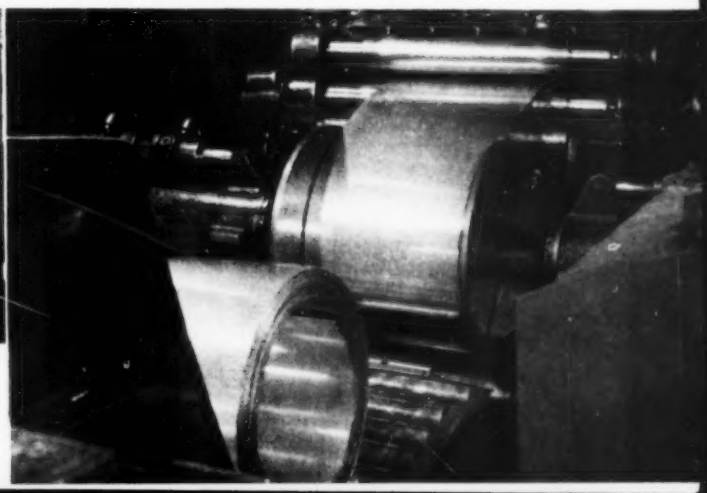
MAKING BRASS BEGINS with these expertly proportioned ingredients, shown ready to go into an induction melting furnace: ingots of copper and zinc, of which brass is an alloy, supplemented by "scrap" brass reclaimed from various sources.

MOLTEN BRASS pours into ladle from one of three induction melting furnaces, biggest of their kind in the brass industry, that feed bar-casting machine. Each 1,000-kilowatt electric furnace has a melting capacity of 10,000 pounds an hour.

LADLE EMPTIES at end of ride on traveling crane and metal pours into electrically heated holding furnace at top of bar-casting machine. From this 9,000-pound-capacity reservoir of molten brass, the metal flows into the mold just below.

BILLETS, below, come from a second continuous-casting machine. Piled bars and billets await tests of samples to verify right composition. Testing laboratory's okay sends the bars to the rolling mill, and the billets to extrusion presses.

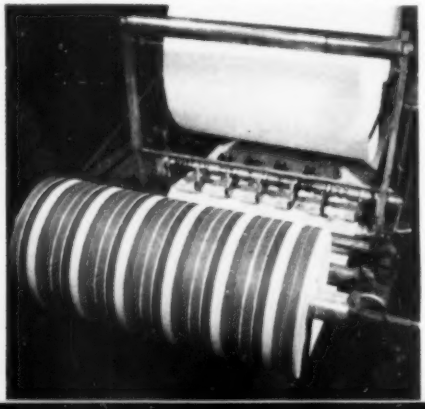
COLD-ROLLING MILL turns bars into brass sheet and strip, in coils like these. Successive passes between rolls reduce thickness to any of a wide range of gauges. The output of the single bar-casting machine—20,000 pounds of brass hourly, 24 hours a day—feeds this great mill, more than a quarter-mile long and 140 feet wide. Finished coils will be made into innumerable items of everyday usefulness for which the colorful metal serves best, including household articles, hardware, automotive and electrical parts.



Victor Hoeflich's party line: hats, leis, favors that enliven festive evenings all over the world.

DESIGNING PARTY GOODS is only part of the job; Hoeflich designs the machinery to make 'em, too. This knife blade makes 2,000 slits a minute to fringe crepe paper for decorations.

PRINTING AND SLITTING MACHINE prints foil in three colors. Then it slits the foil into the long ribbons that are used to make horns. Hoeflich invented his own ink for quicker drying.



He Puts the Noise in New Year's

Meet Hoeflich, Brooklyn's impresario of discord, who sits up nights thinking up new ways, each year, to murder the peace.

By Gardner Soule

VICTOR THEODORE HOEFLICH, 59, is responsible for more unnecessary noise than any other man in history. He manufactures tin horns. Plastic horns. Paper horns. And any other noisemakers he can think of. Provided, he says, that the sound is raucous enough.

Hoeflich, in the weeks just past, has been one of the busiest citizens in the U. S. He shipped out, for 1956 New Year's parties, over 10 million noisemakers—or enough to supply some of the needs, at least, of every party given in the U. S. and its possessions.

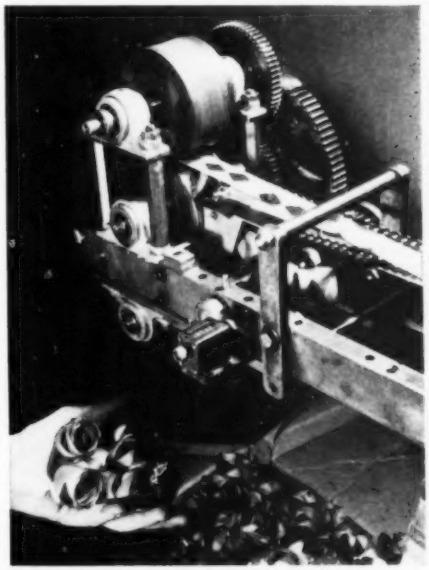
If you had one guess as to where Hoeflich works, and you picked the noisiest place you could think of, you would be right: Brooklyn, N. Y. Hoeflich was largely responsible for the din that was heard from coast to coast last October after the Dodgers won the World Series. Thousands of citizens, parading the streets, found that his devices helped them give vent to their joy long after their larynxes had given out.

High school to high jinks. The great demand for Hoeflich's products after the World Series was something he took in stride. He had prepared longer and more thoroughly, perhaps, for the Dodger victory parties than any other resident of Brooklyn. He started preparing for the occasion 42 years ago when he was a high-school boy in Oregon.

Those were depression days and Hoeflich, penniless, played the violin and banjo in an orchestra to get through school. Parties were dull, and business was scanty, so the orchestra decided to liven things up with favors—in particular, Hawaiian leis—to attract customers. Hoeflich priced the leis: 25 cents each, way beyond the orchestra's resources.

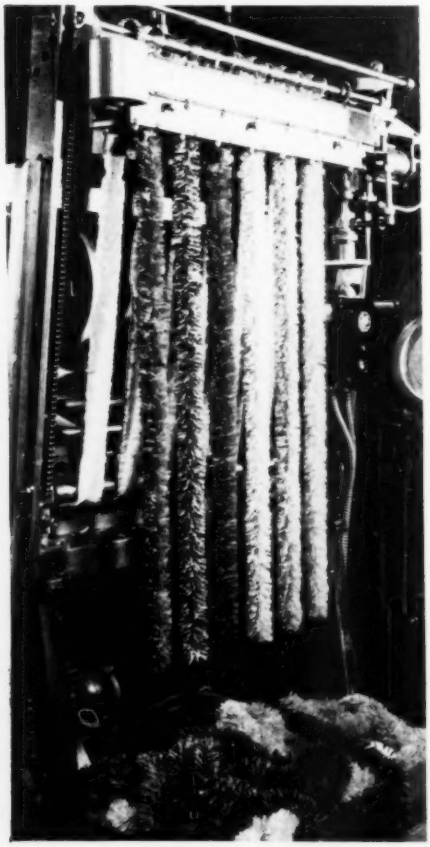
So Hoeflich, who was 17 and mechanically inclined, built a machine to make leis. He built it, he says, of two gears from an automobile, parts from a bicycle, an Edison phonograph, a music rack, pieces of binder from a loose-leaf notebook, some oak and a darning needle.

The finished contraption produced a lei every 15 minutes, or three times



BLOWOUT MACHINE (Hoeflich is shown puffing on a blowout on the facing page) glues, wires, and curls paper tubes of blowouts. Fastest in the world, it produces 150 a minute.

HAWAIIAN LEIS begin at this end of lei-making machine in the Brooklyn, N. Y., plant. Seventy-two rolls of paper spin simultaneously into six continuous leis. Each lei contains 12 colors.



FINISHED LEIS come out of the other end of the machine shown at top of page. Compressed air, piped through the Hoeflich plant, twists the paper into leis, cuts them to desired length.

faster, he learned, than a Hawaiian could make one by hand.

Tinkering pays off. Hoeflich, who thus started as a gadgeteer, has never stopped tinkering—and he has made it pay to the tune of a business that today hauls in almost two million dollars a year. He still designs and builds his own machinery (and sells it to his competition). He has not yet stopped tinkering with his lei-making machine. Today he has a model into which you feed rolls of crepe paper, then watch the finished paper leis come out.

The leis may be any color. This fact saved Hoeflich's shirt one year when the market for leis collapsed. He simply made nothing but red ones, called them Christmas wreaths, and kept selling.

Aloha from Brooklyn. Today Hoeflich makes over 6,000 miles of leis a year, or enough to stretch from Brooklyn to Hawaii, which is his principal market. When you are welcomed to Honolulu, chances are that the lei that will be draped around your neck by that hula-skirted glamour girl came right out of Hoeflich's Brooklyn plant.

From those first leis, it was just a

STEEL DISKS are slipped by hand into the plastic mouthpieces of noisemakers. The turntable revolves, and the mouthpieces are air-blown through the arching tube to a box on the floor.

question of time until Hoeflich had added all kinds of party favors to his list of products. His company, the American Merri-Lei Corp., is today the largest in the field. This does not mean that Hoeflich has solved all his problems. Far from it. There is, for example, the sounds made by his party horns.

"Our noise," he says, "must be right. We must not get a musical tone on one of our noisemakers.

"Unless we are very careful, that is exactly what happens. We make our mouthpieces and the tiny metal reeds in them by machine. Our fine tooling produces such splendid reeds and mouthpieces that a pleasant sound, unless we avoid it at all costs, is likely to result. This pleasant sound would be something like a note on a clarinet. It would never, never do.

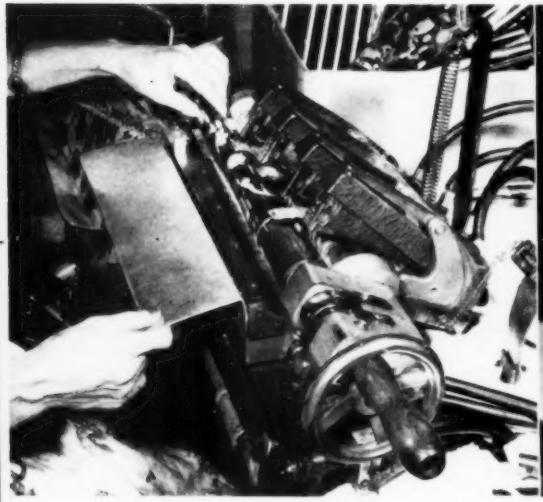
"A raucous tone," he says, "is our objective. This is a little bit difficult to get. To get it, we weight the ends of our reeds a little—that is, we make the reeds a little less harmonious than the machines turn them out. That changes the vibration rate, and produces sounds you never heard before."

AIR PRESS applies a ton of pressure to fasten the top of the crown on this plug hat. "My hats," says Hoeflich, "are a combination of artistic design and mechanical achievement."

Outer-space horn. One of his current specialties, explains Hoeflich, who is frankly delighted with his results to date, is the Planet Patrol. This is a rocket-shaped horn that makes a noise like a siren. "People," says Hoeflich, "even mistake our noisemakers for spaceships."

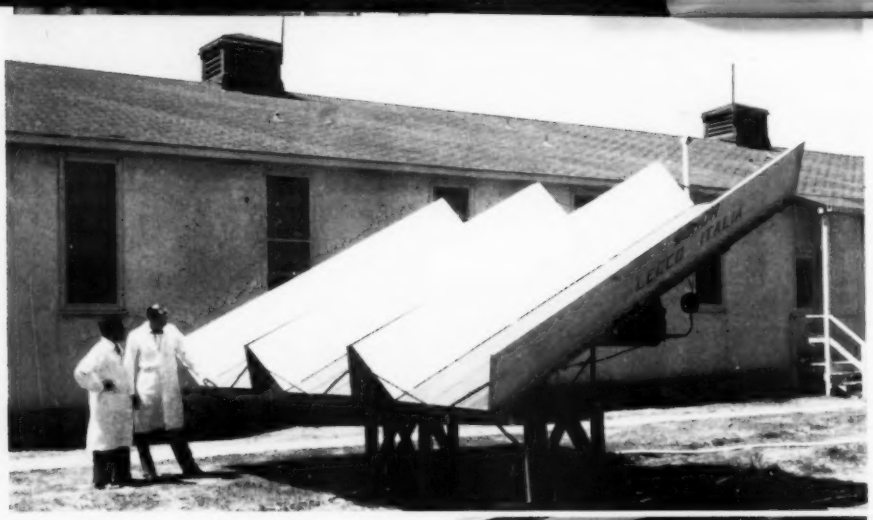
Hoeflich recently shipped out 10 million noisemakers ranging in length from seven

[*Continued on page 252*]

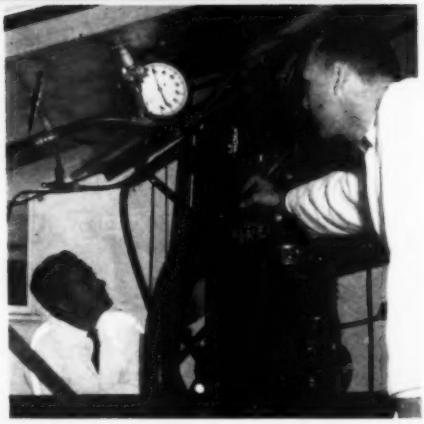


CARDBOARD is fed around the cylinder of a horn-rolling machine, which makes it into a horn. Four air-activated staplers of Hoeflich manufacture tack together the sides of the horn.

FINISHED HORNS, mouthpieces attached, are tested for sound. A girl holds each over a jet of air that simulates your breath. This raucous bedlam is continuous in the Hoeflich plant.



Sun-Driven Engine Runs a Water Pump



USING heat from the sun in an evaporation-condensation cycle, this engine turns out one horsepower to operate a water pump.

Sulfur dioxide vaporized in flat-plate heat collectors (above) drives the one-cylinder engine (right). The gas is then condensed in water-cooled pipes, and sulfur dioxide is returned to the collectors where evaporation continues. The pump is run off the engine's flywheel. The collectors are glass-topped iron beds with hinged covers that act as reflectors to increase heat.

The Italian-built solar engine is under study at the Stanford Research Institute.

Four-Door Hardtop Is Newest Member of 1956 Mercury Family

TRACING its lineage from the sports phaetons of the '20s, a Mercury Phaeton is making its appearance in the 1956 Montclair line. It's a four-door hardtop without a center pillar to obstruct vision. Instead, the rear door is hinged on a door-top-level post that is anchored to the floor. Entrance to the back seat is 24 inches wide.

Revolving House Turns on Its Axis to Keep Face Toward Sun

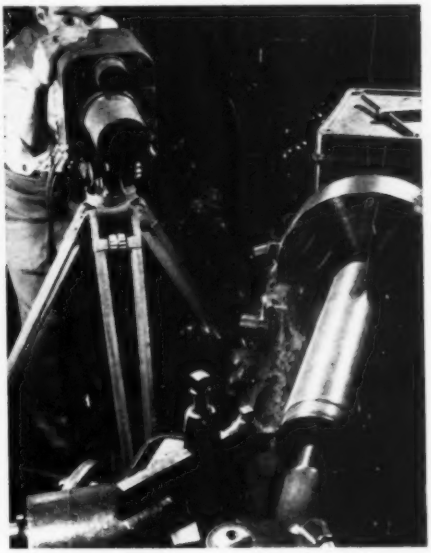
WITH a home like this you could have sun in your living-room windows all day long. The two-story upper section is mounted on wheels that run on circular tracks laid between grass plots on a roof terrace. Electric motors revolve it around a central tower at a speed that keeps the main living quarters always on the sunny side. The house, which is in Verona, was built by Dr. Angelo Invernizzi, an Italian engineer.

Outdoor Oven Cooks with Sun

TEMPERATURES above 425 degrees—enough to roast a turkey or a cut of beef—are developed on sunny days in this aluminum solar oven built at Stanford Research Institute. Reflectors concentrate sun rays on a heat plate; insulation keeps the oven hot.

Heat Measured by Radiation

A NEW camera-like instrument, called a radiometer, measures heat by being focused on an object, such as the cutting tool below, overhead transmission lines or moving parts. An optical system in the Barnes Engineering Co. device records the infrared radiation.



Why Drivers Like New Little Taxis

Everything is powered but the passenger. Happy hackies say, "Driver fatigue? What's that?"

By E. D. Fales Jr.

IF YOU took the best features of the new taxis this year and lumped them all in one model you'd have a taxi driver's dream hack, which will probably never exist. But even unlumped, things look pretty good.

One driver summed it up the other day. "Shucks," he said "driving a hack this year is a *desk* job!"

And no wonder. The makers are wooing riders with new gimmicks; but more, they're wooing the driver and making his life less killing than it used to be. The cabs are smaller, lighter, easier to handle. Drivers don't get tired!

Today's hackie can get his call by radio, check a warning light to see if all doors are closed, push a button to get rolling, let his motor turn his wheels and push his brakes.

If he doesn't want company, he can pull down a Plexiglas panel (the way you close an overhead garage door) and seal himself off. If he ever feels a pistol at his neck, he can flip a secret switch and start "bandit lights" flashing on his roof to SOS the cops.

If he dents a fender, mechanics loosen 12 bolts, slap on a new one, and in 20 minutes he's on his way. That's important because taxis, like everybody, must keep *working* to earn money.

Not all of these advantages are on any one cab this year, nor are they all new. But together, they're taking the growl out of hacking.

The driver doesn't have a push-button door closer yet, but that may come. In Detroit, some hackies have installed pull-chains—from the front seat to the right

JUMP SEATS FACE RIGHT at a 45-degree angle, giving more leg room. They fold into the floor. Note the Plexiglas panel which can be lowered behind driver when passengers want privacy.

MOTOR-DRIVEN REAR WINDOW opens when driver flips switch, giving through ventilation on hot days. Motor, in trunk, pushes two riser arms which are hinged to chrome strips on glass.

THE FENDER COMES OFF. Outer section of new Checker's fender can be replaced in 20 minutes. Inner section also unbolts for repairs, and can be removed and replaced in another 20 minutes.

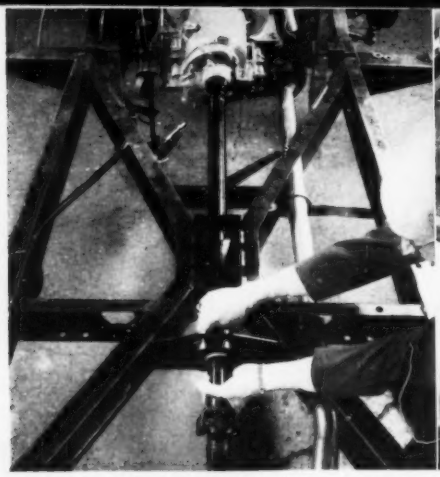
rear door. That saves a long stretch if the passenger gets out and leaves the door open.

The replaceable fender is on Checker's new "little giant" cab. If damage is light, you unbolt the outer half of the fender shell. Or you can unbolt the whole thing by taking off another 15 nuts.

Checker also has a quick-replace grille. Shop time: 20 minutes. The new bumper is one piece of steel, not three.

The new Checker is the newest "small cab." For years Checker made big seven-passenger jobs. They were heavy, costly and 208 inches long. Ford, Chevvy and Plymouth swarmed into the small-cab field. The crisis came when traffic-choked New York City, after years of stubborn

BATTERY HAS BEEN MOVED AFT, now nests in floor of the trunk. To service, you remove a spring-clipped trap door. Although the new Checker is smaller, its trunk holds more luggage.

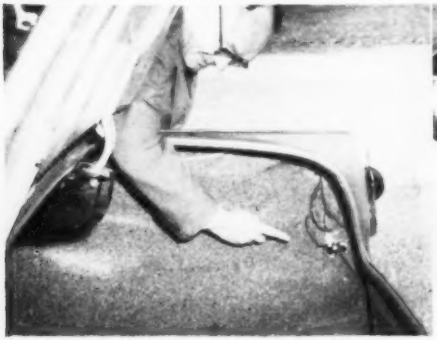


THIS IS THE MIDSHIP BEARING that makes possible a two-piece shaft and eliminates the back-seat floor hump. Lined with a rubber sleeve, it allows ½-inch shaft play without noise.

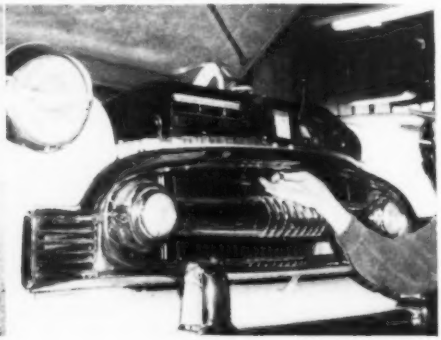
BARE ARMRESTS—no upholstery—are metal stampings covered with a tough paint that not even a hammer blow will damage. Note the flat back-seat floor minus the drive-shaft hump.

On the Checker: a humpless floor, a buzzer, a new latch

RATTLESNAKE TAIL—a noisy buzzer—sounds automatically as soon as you throw shift lever into reverse. It is small, but loud enough to warn bystanders that cab is going to back up.



HOOD-LATCH LEVER has been relocated to be visible from outside of cab. The grille is of two-piece sheet-metal construction and can be removed and replaced in 20 minutes.



insistence that only limousine-length cars were safe for paying passengers: legalized small stock cars for taxi use. Checker stopped production and did a retake.

Now its Kalamazoo plant has come out with a competitive small car which, by some mechanical legerdemain, is still huge inside. In fact, it seats one more person than even the old battleships: eight—including the driver. And this on a 200-inch over-all length—4.8 inches less than Plymouth's new "special cab." Other cabs seat six including the driver.

How do they get all these people in the Checker cab? The main gimmick is turning the jump seats at a 45-degree angle to the right. With the cab shortened from front to rear the only knee room left was in the width. So passengers will sit turned halfway to one side.

Checker made still more room in its 200 inches by lopping off overhang at both ends and shoving the radiator back to ⅞ of an inch from the fan. They uncrowded the engine compartment by moving the battery to the trunk compartment, where, says Sales Manager Ralph West, its 68 pounds helps traction. More important, the battery stays cooler there and (West says) lasts longer.

Powering this little giant is the same L-head six that Checker used in its big cars. Compression: 6.7:1. Horsepower: 88. "What taxi needs more?" West demands. The speedometer goes to 100, but the cab itself goes only to 70. With a 113-hp. engine, which is also available, the cab may do 95.

The Checker people claim to have the first "automatic cab." It offers power controls and a "Driv-er-matic" torque-converter transmission specially designed by Detroit Gear. The frame is beefed by double construction forward, for collision shocks.

In spite of the small market (total U.S. sales: around 20,000 a year), Dodge and American Motors (Hudson Rambler) are also getting into the taxi-sales push. But the three big sellers are Ford, Chevrolet and Plymouth. Unlike Checker, which has the only U.S. plant whose main business is taxis, they've been selling "taxi packages." This means that you order a stock car, but pay extra (on one model about $22) for heavy-duty taxi springs and shocks, and especially rugged seats and interiors (in some cities the law requires that taxis must be *hosed out* every night). You can buy extras, too. Everybody offers automatic transmission.

To spike the idea that taxis are just fixed-up stock cars, the makers of Plymouth this year announced a "special cab." These come down the same line as stock cars, but get special treatment en route. Among other things, the frame is beefed forward with welded gussets.

Chevrolet features a heavy-duty mainshaft bearing, fast-fill gas tank, reinforced rear seat with twice the usual number of transverse springs, special taxi steering wheel with horn button (which Chevvy designers say taxi drivers like better than horn rings). There's a single key for ignition and trunk, and a 1½-inch wider door.

Because taxis do a lot of idling, an 18-inch Cadillac fan cools the engine. A governor can be had. New York fleet owners are said to set it at 45 m.p.h. Engine, frame, battery and transmissions

[*Continued on page 274*]

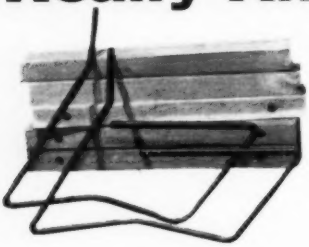
Plymouth special cab has new driver conveniences

LUBRICATING WINDOW LIFT is simpler in new Plymouth cabs. Just remove a vinyl-covered snap-off panel, then an inner panel in the door.

DRIVER'S CLIPBOARD can be racked neatly in door. Plymouth also installs a dash holder for the money changer that many drivers use.

DOOR-HANDLE GUARDS keep passengers from elbowing doors open by accident—a common problem with tipsy fares who lurch against them.

Here's Furniture You Really Knock Together



THE old expression, "All you need is a screwdriver," was chucked out of the window by William E. Briggs, a Nashville, Tenn., architect, when he dreamed up his "Outdoors-In" furniture.

The knock-together furniture can be assembled without any tools—though a hammer helps. There are no screws in it.

1 SEAT BOARDS are tapped on as helper holds rods. A magazine is used to protect wood.

2 CAP BLOCK of the seat is knocked tightly home. Magazine now serves as a spacer.

3 WITH CHAIR ABLE TO STAND on its own legs, first back board is started on the rods.

4 BACK CAP BOARD is tapped firmly into place, completing the simple chair assembly.

Nor nails. Nor glue. It is held together by a principle.

The principle is well-known—cantilever construction. It is attained in this case by bending iron rods. Common two-by-fours drilled so that they slide snugly over the rods form the backrest and the bridge-like suspension seat of the chair.

You simply tap the two-by-fours onto the bent rods. Once in place, the drilled boards lock the rods in position. The cantilever design gives a comfortably firm spring to chair seats and backs. To make benches, tables or carts, you start with iron rod shaped into squares and other forms.

The name Outdoors-In comes from the fact that the furniture, although rugged and weather-resistant for outside living, is also designed to harmonize with most interiors.

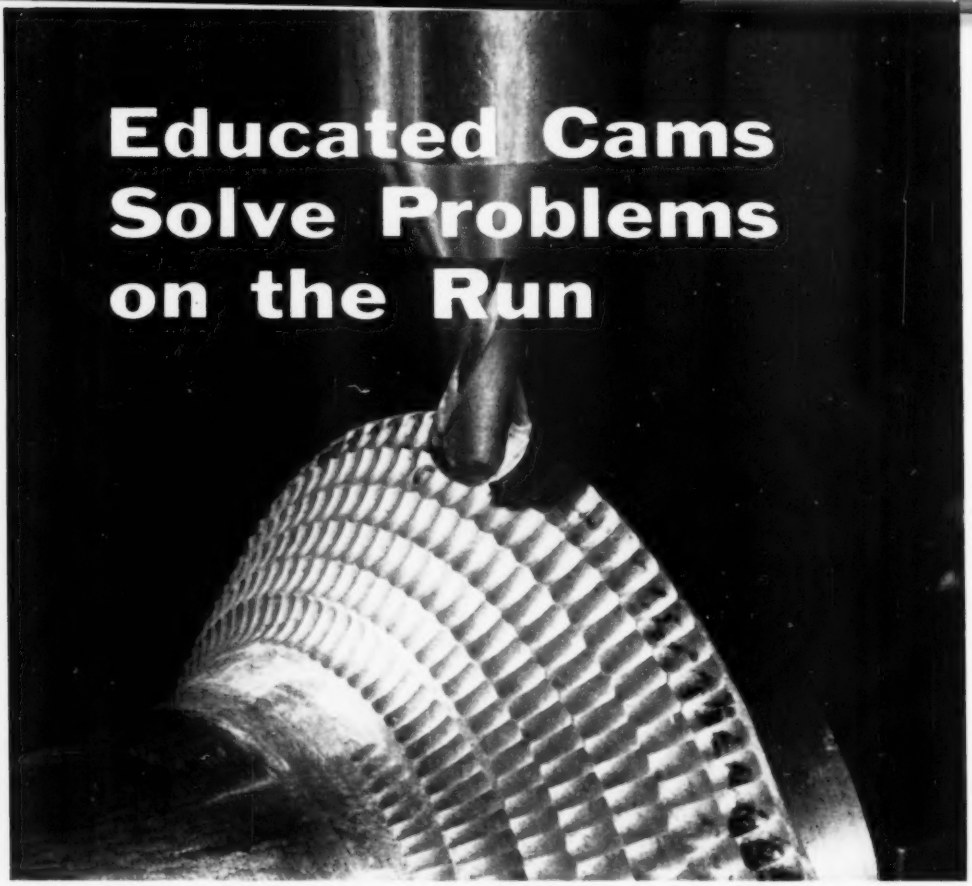
So far most of the furniture has been built by Briggs for his friends, using red cedar and pine. But, since his job as an architect doesn't give him much time for this side line, he recently turned the manufacture over to Southern Craftmasters of nearby Columbia, Tenn.

A close look at the pictures may spur you to try your own workshop versions. This furniture is almost as easy to make, says Briggs, as it is to assemble.

...and This Kind Slips into Shape

FROM Canada comes another idea for simple-to-make furniture that holds together stoutly without benefit of nails, screws or glue. The parts, as shown in the chair being assembled above, are cut from ¾-inch birch plywood panels. Slip-in slots tie the pieces together, securely interlocking them. International Fibre Board and Plywood Sales, Ltd., of Gatineau, Quebec, originator of Ply-Tie furniture, offers plans for six assemble-it-yourself items: two chairs and four tables. A workshopper, experimenting on his own, might expand these basic designs to include settees, shelves and cabinets.

Educated Cams Solve Problems on the Run



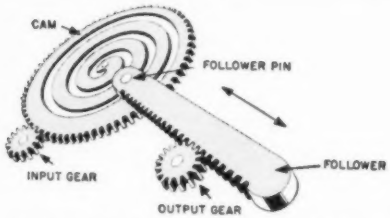
COMPLEX CONTOUR of a master 3-D cam is made by first milling as many as 16,000 data points. Metal between the points is then precision hand-filed to create the finished shape.

THE simple, flat cams that lift and drop the valves in the engine of your car are morons. Their bright brothers of today not only are three-dimensional but have mathematical memories.

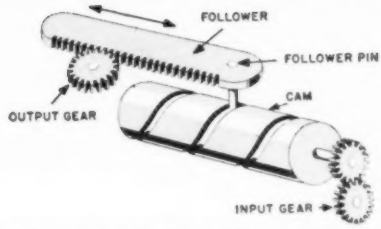
Instead of merely using their eccentric shapes to impart motion to other parts, their oddly contoured surfaces store a mass of information that gives split-second answers to many complicated problems posed by the automatic computers of push-button warfare and industrial robots. To tap brains into metal, the Ford Instrument Co., of Long Island City, N. Y., precision-machine as many as 16,000 data, or reference, points to form the contour of a single master cam. This is duplicated, with an accuracy of .0005 inch, in smaller production cams.

One cam, used in gunfire-control computers, has a ballistic memory. It has "memorized" flight characteristics of the missile. When elevation and range are fed into it, the cam coordinates them and tells the computer how much added or superelevation the gun needs to put its shell on the target.

Airborne, similar memory aids give the navigational computers of jet planes immediate corrections for the curvature of the earth between any two latitudes or for magnetic variations. For automatic bombing systems they remember complex bomb characteristics. And even better-educated cams are in the works as memory jogs for the computers to control supersonic missiles.

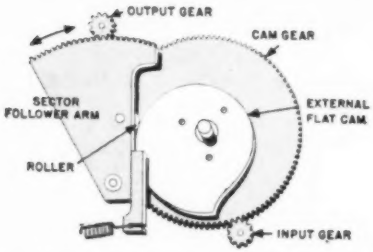


GROOVED FLAT CAM HAS RADIAL FOLLOWER

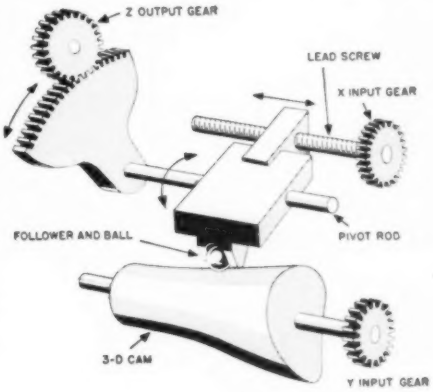


GROOVED SOLID-METAL CYLINDRICAL CAM

In this family of cams, the 3-D is the brainy one with a memory. But they all impart movement with precision.



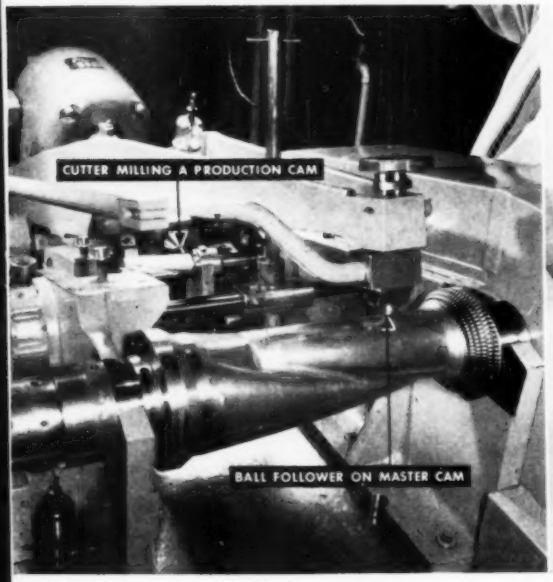
FLAT CAM HAVING AN ANGULAR FOLLOWER

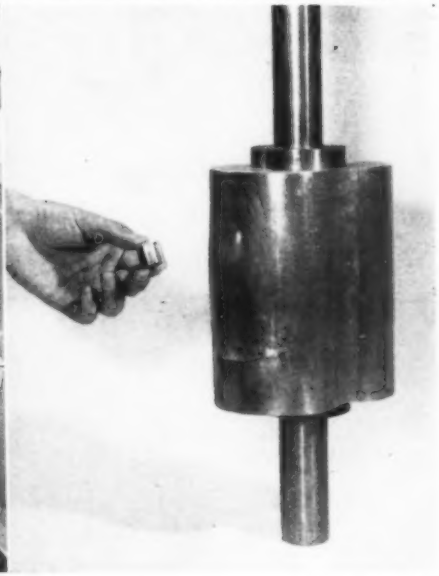


A 3-D CAM CAN HANDLE TWO DATA INPUTS

MASTER CAM is placed in a pantograph duplicating machine that mills the reduced-size production cams. A variable-speed device slows it down when cutting tricky curves.

FOUR MONTHS OF CRAFTWORK may go into making a big master 3-D cam such as the one shown below. The hand-held production copy is machine-milled in less than two hours.



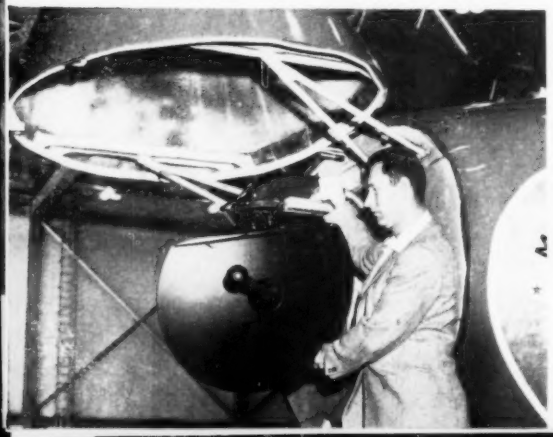


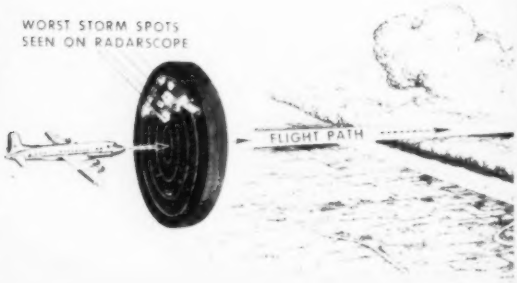
New in Aviation

Atomic Punch This supersonic F-100C, new version of the North American Super Sabre, is carrying 7,000 pounds of conventional bombs, but it can also deliver A-bombs. It is the first model of the Tactical Air Command fighter

Drone This small, unmanned craft carries cameras for Army aerial combat reconnaissance. Although it is catapulted into the air with jet assist, its prop is spun in flight by a gasoline engine. The RP-71 is radio-controlled from the ground. At the end of a mission, it is brought back to the launching area and lowered gently to the ground by means of a parachute.

Weather Eye Stormy weather is being licked by airliners carrying a radar nose, shown below installed in a United Air Lines Convair 340. This weather eye peers deep into storm areas ahead and presents a picture on a scope in the



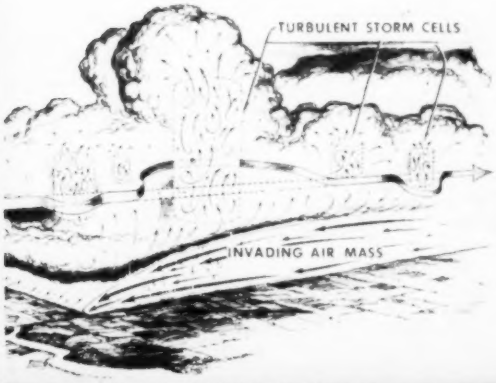


with a probe (arrow) for the probe-and-drogue method of mid-air refueling. This will enable three jets to drink at one time.

Rocket-Jet This engine is expected by British engineers to fly at 2,000 miles an hour. The rockets, at rear, would boost a plane, or missile, past the speed of sound, where the ramjet engine, forward, would fire up and take over. The United States is experimenting with a similar idea of combination power plants.

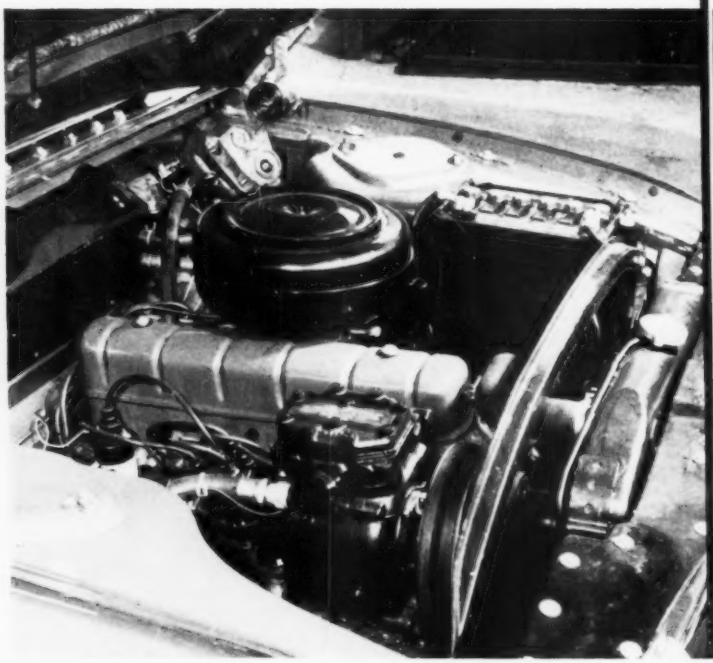
Small But Snug In this tiny Bell research plane, the X-2, Air Force test pilots are probing the heat barrier. They want to know more about the effects of high friction heat on both pilots and planes—a problem encountered in flying much faster than the speed of sound.

cockpit. The pilot avoids the spots of severest turbulence and flies through smooth corridors, as indicated in the drawing.



Control Tower This air-traffic control tower was developed by the Air Force to be carried in a small transport plane or towed by a jeep to remote areas. During travel, the astrodome folds into the main unit which is aluminum insulated with foam plastic. It is air-conditioned for comfort in all climates.

Rambler Puts a New Engine in a



NOT everyone in Detroit seems to believe that size sells cars. The thinkers for American Motors, convinced that there's a place for a U.S. car that is not swollen up with grandeur, are betting their 1956 shirts on the conviction. (The strength of Detroit's herd instinct, however, is such that even the new Rambler is just a *little* bigger.)

There are four main areas of news on the 1956 Rambler:

- A new 120-hp. overhead-valve six, up 33 percent in power over 1955. It livens up performance without upsetting the fuel-stingy habits that helped Rambler win the last Economy Run.
- A new set of interior body dimensions, comparable to those of the Big Three.
- A new look outside, with an odd rear pillar having a strident, "The-hell-you-say" touch that is believed in Detroit circles to be *the* magic styling ingredient.
- A slick-trick station wagon for the burgeoning suburban trade. Main gimmick: a crank-down tailgate window.

Introspection. More than a year ago, American Motors made a confidential evaluation of the Rambler. It came as no surprise, when this writer happened on this analysis, to find that the company discovered plenty of virtues in its principal product. The major liabilities that the company privately conceded were more interesting: a) modest power and performance; b) narrow wheel tread; c) insufficient shoulder room; d) small

The first major redesign in its history makes the cocky little Rambler almost as big as the big boys.

New Body

By Frank Rowsome Jr.

brake-lining area; e) small trunk space; and f) the absence of a major styling change since the car was introduced in 1950. Now, something has been done about each of these things.

The new engine. A tough problem faced American Motors' engine people: They were tooled for a sturdy, docile L-head six that was highly satisfactory in everything but top output. They didn't have the time for the kind of all-out program that a brand-new V-8 would require. Kicking up compression on the old job would give the needed power, or part of it, but it would also have made the engine finicky about fuel, and might have hurt reliability.

So they brewed up an ingenious solu-

SWEPT-BACK REAR PILLAR and a slightly inset rear window are two styling identifications. The tilt to the pillar isn't pure chi-chi: it gives the back-seat passengers better vision.

PRETTIFIED PANEL centralizes the controls and instruments. This car has dual-range Hydra-Matic, but a standard-shift gearbox, with or without overdrive, can also be obtained.

AMPUTATED DOOR POST in the four-door hardtop (shown on previous page) is stiffened by an inward-curved brace. Rambler's unit body construction gives it good torsional rigidity.

tion: an OHV six deliberately made as much like its L-head predecessor as possible. This saved design time and parts changing; and it also allowed the company to re-use some of its existing tooling. (New tooling swallows money and time in staggering amounts.)

The bore and stroke (3⅛ by 4½ inches), the displacement (195.6 cubic inches), and the compression ratio (7.4:1) are all identical with those of the earlier job. Power is up 30 hp. to 120, and torque is up 20 pound-feet to 170. The engine nevertheless gains a whisker on fuel consumption, and it stays contented on regular gas.

Propelling a car that, at 2,750 pounds, is almost 200 pounds heavier than last year, the engine yields a perky 22.9 pounds per horsepower, in contrast to 1955's somewhat torpid 26.5 lb./hp. Although not a vulgar wheel-squealer, the Rambler now willingly lays into it when you apply the spurs.

Under the hood you can spot the engine's close kinship to the OHV six that has powered recent Nash Ambassadors. Except for using a four-bearing crank rather than a seven-bearing one, and for using more modest carburetion and exhaust manifolding, the little fellow is a kid brother to the Nash "Le Mans" power plant. It uses an integrally cast intake manifold, and has the same low water-pump location that Nash has long favored. Though the company won't underline it, performance-minded owners can get 10 extra horses simply by subbing a two-barrel Statesman carburetor for the one-barrel one provided.

Other mechanical changes. The brake-lining area has been boosted to 153.4 sq. in. It was a scanty 104.3. Bendix power brakes are standard on the tricked-out models. The car has a full line of currently fashionable gadgetry: suspended clutch and brake pedals, a 12-volt electrical system and an option of power steering—which the company cheerfully admits isn't really needed on so light a car. You still have to crank the windows up and down.

The main change in the running gear is the adoption of torque-tube drive in place of the previous Hotchkiss setup. Company engineers, enigmatic about making a switch that bucks recent trends, say that it permits using coil springs all around without greatly increasing the weight.

Rambler handling, which has always been good, has been helped by increases in both the front and rear tread (the latter is up a startling five inches to 58), and by a new front cross member between the lower control arms. The turning diameter holds at 38 feet, so that, with its 23:1 steering ratio, the little

INSIDE HEADLIGHTS and outside turn lights are front identification details shared with Nash. Rambler air conditioning, redesigned this year, puts evaporator behind big grille openings.

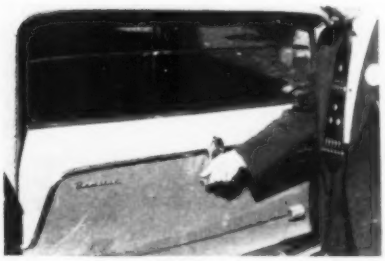
AIRY SPARE, optional on the sedan and hardtop, slightly reduces the car's excellent parkability by adding to over-all length. Luggage space is up 125 percent this year to 22.4 cubic feet.

car is agile in close-quarters maneuvers.

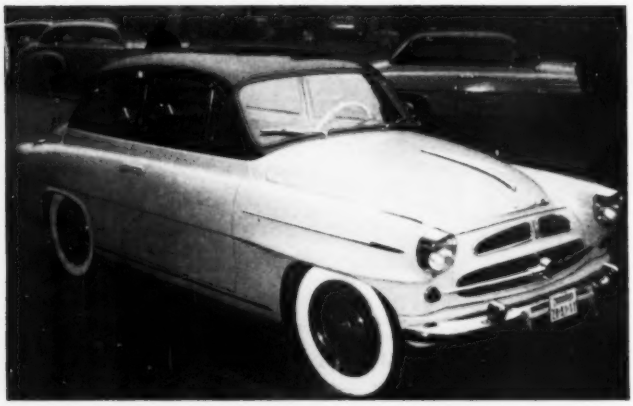
Those new dimensions. Though the wheelbase remains 108 inches, over-all length has crept up almost five inches to 191.14. It is still substantially less than that of most American cars, which is a solace when you are parking.

Inside, the changes are extensive but subtle: The car doesn't look roomier, but when you try it on for size, those critical last inches are there. Front and rear shoulder room have been widened by a comforting five inches, and rear leg room increased by 2.5 inches. Almost all passenger-fitting dimensions, the company points out aggressively, are virtually the same as those of Ford-Chevvy-Plymouth. Some dimensions match those of cars in the Mercury-Pontiac-Buick Special class.

This is not to say, however, that you will rattle around in a Rambler like a pea in a pod. It means that if you have the misfortune—automotively speaking—to be fairly tall, you will emerge from a long trip in a Rambler no more seriously cramped than if you'd been in some other make of car. END



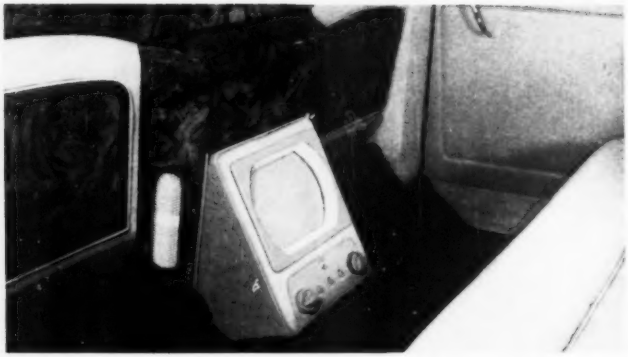
NEW NOTION in the station wagon eliminates the swing-up window on which so many noggins have been knocked. Instead, you just grab the rear lock and crank it vigorously, whereupon the glass retracts into the tailgate. And there's never a rattle from a propped-open back window. Crank can be reached from outside only.



Czechs Build 4-Cylinder Car With 43 Hp.

THIS Skoda, a four-cylinder car from Czechoslovakia, is being offered for sale at auto shows in Western Europe.

Its water-cooled, 65-cubic-inch engine puts out 43 hp. and is said to get 40 m.p.g. Other features are a split-drive axle and built-in chassis lubrication.



TV at Your Feet Rides with You In Rolls-Royce

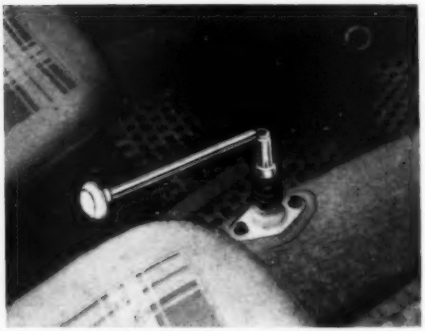
A NINE-INCH TV mounted on the floor picks up programs from stations 30 miles away to entertain rear-seat riders in this swanky Rolls-Royce.

Hooked up to the 12-volt battery, the set uses as much current as one headlight.

Do-It-Yourself Adjustment for Shock Absorber

STRAIGHT, direct-acting shock absorbers are ordinarily not externally adjustable; but a new French type (left) is. A flick of the lever changes a car's ride to suit road surfaces or load.

It works by changing the effective diameter of an oil port inside. Sold abroad under the name Vulcam, the new shock has the same adjustable characteristic that older lever-type shock absorbers had.



Gearshift Folds Out of the Way

THIS folding gearshift gives occupants more room to move in and out of the front seat of small German cars. A slight upward tug disengages the lever so it can be held horizontally by a spring-drawn chain in the housing. In use upright, chain tension clamps it to the main shift sleeve on the floor.

New Ideas

FROM THE INVENTORS

1 Ski Tow to Climb Hills. This mobile power plant could turn almost any snow-covered slope into a modern ski run. Built on a caterpillar-treaded cart, the engine could be toted in a car trunk and would propel itself over snowy ground. Then, chained to a tree and fitted with a rope on a pulley, it would tow skiers uphill.

2 Purse to Change Color. With this foundation handbag and an assortment of slip-on covers, a woman could match her pocketbook to any outfit. It would save her the cost of a closetful of bags and spare her the bother of transferring contents.

3 Heater to Warm Car Seat. A fast-acting electric seat warmer might ward off icy-morning shivers while you waited for the regular heater to warm up. In a GM patent, a door switch turns on a quick-heater, then thermostats lower the current.

Please turn the page for more new ideas

MORE New Ideas from the Inventors

4 Auger to Bore Ice. A winter angler could drill fishing holes through thick ice quickly and easily with this modified brace and bit. The offset handle would turn a concave, saw-edged shovel which, the inventor says, would bite cleanly into ice, scoop out chips, and form a smooth opening free of jagged, line-fraying edges.

5 Flap to Mute Horn. A car or truck horn that can throw its voice a safe distance on a highway sounds louder than Joshua's trumpet at close range. To spare the nerves—and eardrums—of those who have to put up with city traffic, this driver-controlled muting flap would tone down a horn from a lusty roar to a gentle beep.

7 Plane Seat to Rotate. You may take off forward and land backward in high-speed planes of the future. Sudden acceleration will jolt you back in your seat, so body, head, and foot supports may be needed to absorb the increased inertia forces of faster planes. To provide the same kind of protection on deceleration—when you'd normally be thrown out of your seat—one inventor would pivot the chairs. He'd use an inertia switch to spin them the right way in response to a speed change. They could also be adjusted in advance—like safety belts—on a signal from the pilot.

6 Chest to Conceal Bed. During the day, this bed would hide inside a narrow, upright chest. The concealed bed would save space in a small apartment, den, or spare room. It could also be used to provide emergency sleeping accommodations in an office, shop, or other room where a regular bed or couch would look out of place.

8 Clockworks to Time Child. There's no use asking a child to come in from play at a certain hour if he's too young to tell time. But with this tamper-proof interval timer pinned to his clothing, you could dial your instructions and let the buzzer remind him when his time runs out.

9 Ladder Steps to Adjust to Job. If you've often faced the equally uncomfortable alternatives of stretching to your work from one rung of a ladder, or stooping down to it from the next, this adjustable-height climber may be the one you've been looking for. The side rails of the steps, held to the ladder frame by brackets, would slide up and down in recessed flanges. To lock the steps in any desired position, lugs would drop into slots on the frame.

U. S. patents on these inventions have been granted to: 1, Charles Budesky, Ferndale, Mich.; 2, Bill Hovis, Cincinnati; 3, Robert L. Ballard, Detroit; 4, Alexander H. Vadnais, St. Paul; 5, Glen H. Johnson, Los Angeles; 6, E. G. Hirst, Leaside, Ontario; 7, William Exton Jr., NYC; 8, Louis Goldman, Framingham, Mass.; 9, Buer H. Buckles, Vienna, Ohio.

HAVING A FIELD DAY, members of the Brotherhood of Live Steamers held their convention in Mrs. Lewis' back yard, making full use of its 15 steaming racks, turntable and tracks.

Back-Yard Locomotive Plant

THE quietest and probably the smallest locomotive works in the U.S. occupies part of a roomy back yard in Lomita, Calif. There, under the direction of an energetic widow whose late husband converted his hobby into a business, four people make parts for scale-model live-steam engines that are marketed in kits all over the world.

Little Engines, as their enterprise is called, makes parts for five different model sizes, ranging in scale from ¾-inch to 1½-inch to the foot, and for a total of 12 types of locomotives.

Essential parts for the kits are either rough-cast or precisely machined, depending on what the purchaser can afford or what he prefers. If he is long on cash but short on power tools and know-how, he may pay as much as $600 for a kit that requires only an electric drill, a set of drawings, and a supply of bolts to assemble. If he has a home workshop and wants to save money, or simply have the fun of machining the parts himself, he can shell out as little as $125 for a kit and pile up the hours doing all the machine work himself.

Through correspondence courses, Mrs. Irene Lewis, who owns and manages Little Engines, taught herself enough mechanical and steam engineering to scale down drawings, cast a boiler or get up a head of steam on an engine.

Now she leaves most of those technical details to her assistant, young Bob Harpur. She devotes herself to managerial matters and the complex job of preparing an annual 90-page catalogue of the hundreds of parts for her scale-model engines. In addition, she corresponds with live-steamer fans and customers throughout the United States, and as far distant as Siam, Europe, South Africa, Australia, South America and Saudi Arabia.—*Wesley S. Griswold.*

OFF ON A 1,000-FOOT JOURNEY on a back-yard track, Bob Harpur here has under steam a 1½-inch-scale model of an Atlantic-type locomotive, assembled from a Little Engines kit.

Prefabs $600 Live Steamers

PREPARING A MOLD of parts for a live steamer, Bob Harpur's helper makes grooves in the sand, where molten metal will flow to form castings when the wooden patterns have been removed.

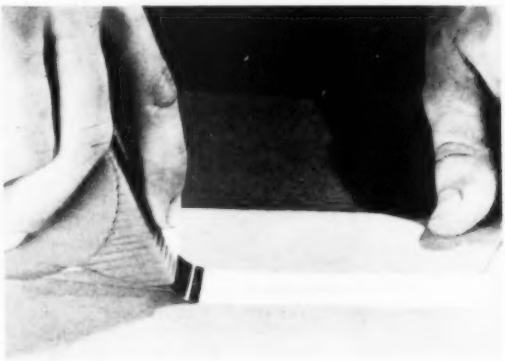
LOCOMOTIVES IN THE ROUGH: This stockpile of castings surrounding Mrs. Lewis is drawn on to make up kits for model railroaders the world over and to fill orders for individual parts.

New for Modern Living

1 Double-Duty Plane Bag. Not only does this 22-inch dress travel case hold 11 pressed garments and hang them (as above) without unpacking, it weighs them on its own scale as you pack to help you keep within airline limitations. The soft-sided Koroseal case is zippered shut.

2 Bike Radio Has Many Uses. Designed to ride the handle bars of a bicycle, this little portable runs on house current or your car battery as well as on a dry-cell power pack. Special brackets and a four-prong extension cable are provided for bike mounting, with the battery on the rear carrier platform as above; or the pack can be clipped to the receiver forming a four-pound portable unit, six inches high.

3 Holder Dispenses Tape. When this handy unit is run over a flap to be sealed, it leaves the proper length of stuck-down cellophane tape without gumming up your fingers in the process. By flipping the dispenser over, you can cut the tape off cleanly on its toothed edge.



Further information about the products described on these pages can be obtained from the following sources: 1. Skyway Luggage Co., 350 5th Ave., NYC 1; 2. Darb, 1316 Yale Place, Minneapolis 3; 3. Cosom Industries, Inc., 6012 Wayzata Blvd., Minneapolis 16; 4. Timely Gifts, P. O. Box 1388, San Diego 12, Calif.; 5. Riegel Textile Corp., 260 Madison Ave., NYC 16; 6. CarnesCraft, P. O. Box 185, Fairfield, Conn.; 7. Vital Products Mfg. Co., 7550 Quincy Ave., Cleveland 4; 8. Beyland Engineering Co., P. O. Box 53, Yalesville, Conn.

4 Guards Protect Heels. Women drivers won't scrape or soil their shoes if these plastic guards are slipped over the heels. The guard covers the back of the shoe where it might rub on the car floor mat. Made to fit Cuban or high heels, they fold to go into a purse.

5 Plastic Pockets. Small plastic dots embedded in the fabric make these pockets outlast your pants, the manufacturer says, even if you are accustomed to stuffing them with bolts, screws, keys and golf tees. You'll find them in many of the work and play pants in the stores this year.

6 Coffee Cooler. If you take your morning coffee on the run, this gadget may keep you from scalding your lip. Its aluminum cylinder absorbs excess heat, and a wooden handle protects your fingers. Kept in the refrigerator overnight, it makes your coffee drinkable even faster.

7 Cookie Gun Shoots Out Dough. A pistol grip with trigger action on this cake decorator and cookie maker helps speed up party preparations. A single loading of batter in this barrel makes 28 cookies; in a larger model, up to 60. Interchangeable tips and dies offer a variety of decorative patterns for cake frostings, cream-cheese, paste canapé fillings and other party delicacies.

8 Kit Preserves LP Records. A new liquid for record care is both a cleanser and a "lubricator." Swabbing with it regularly, says its maker, reduces static, needle hiss and surface noises and extends the life of your LP records. Besides the five-ounce bottle of Quiet (enough for 200 or more 10-inch records), there's an applicator, cleanser-holding tray and needle brush in the kit.

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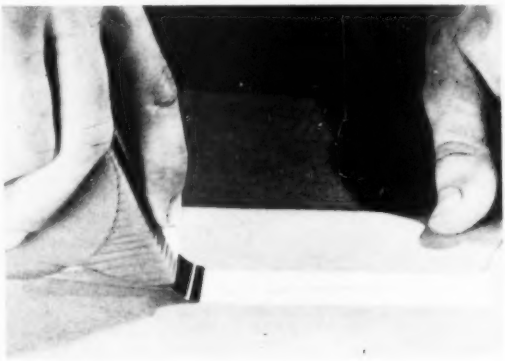

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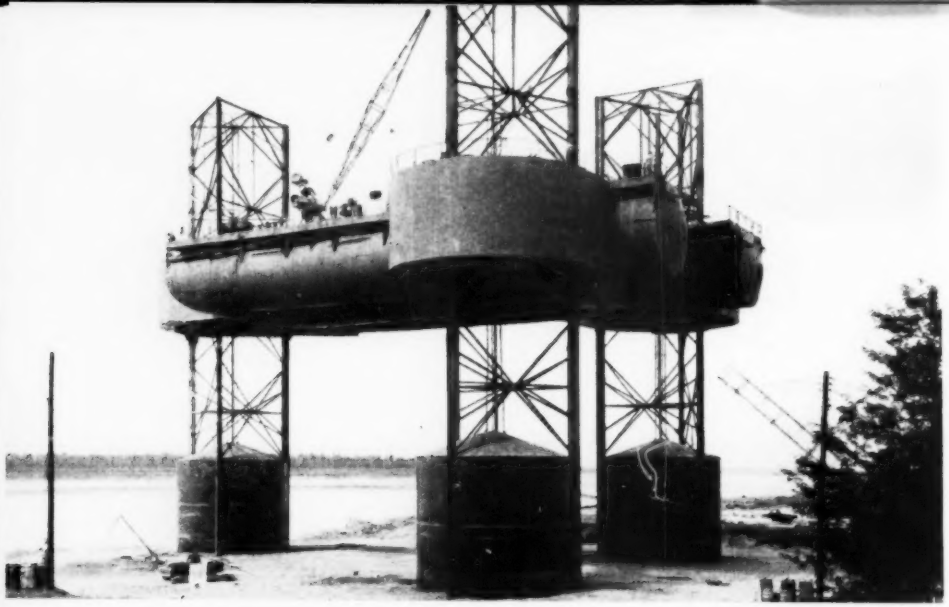
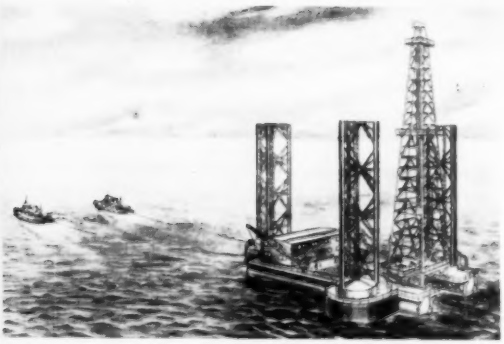




Floating Derrick to Drill Oil, Move On to New Gulf Site

THIS 4,000-ton floating island will range the Gulf of Mexico's oil-rich fields. Equipped with a derrick, it will be towed (as in drawing at left) to a likely offshore site to drop its 140-foot legs to the Gulf floor and drill as deep as three miles. One job done, it will pull in its legs and be moved to another spot with equipment and 42-man crew housed on its half-acre deck. Texas builder LeTourneau, Inc., puts its cost at approximately that of one stationary platform—$2,000,000.

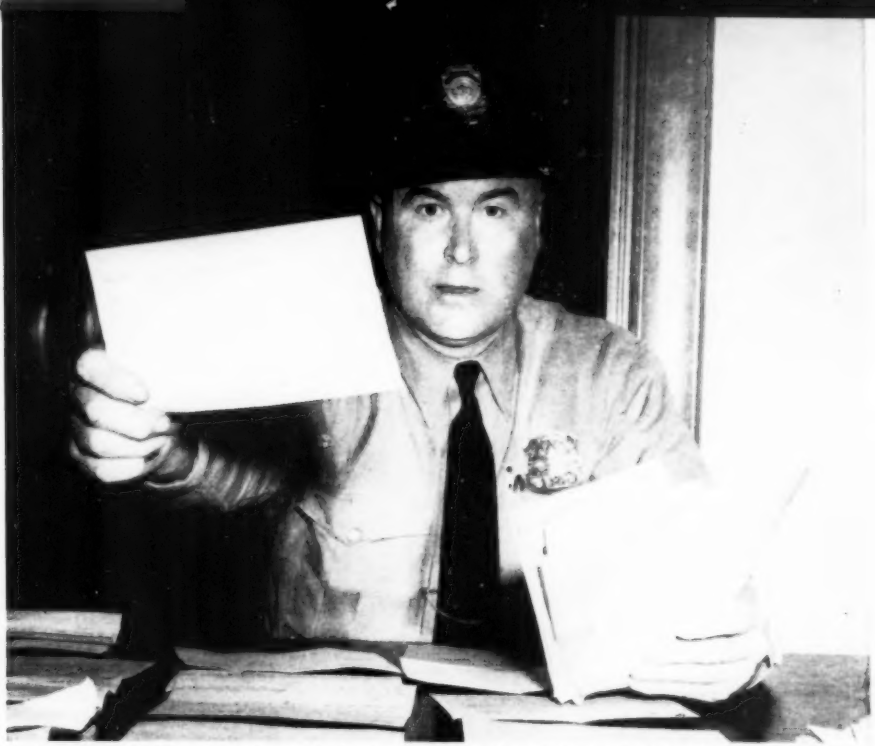
They Say Now.....

PROF. JOEL H. HILDEBRAND, PRESIDENT OF THE AMERICAN CHEMICAL SOCIETY: *"Having once embarked upon a technological civilization, we are like men traveling by boat down the Colorado River: we cannot turn back; we must apply our utmost knowledge, skill, and intelligence to keep going."*

GEN. THOMAS D. WHITE, AIR FORCE VICE CHIEF OF STAFF: *"It is conceivable that a nuclear-powered, water-based aircraft may become an effective bomber . . . New engine developments may enable the water-based bomber to take its place alongside other Air Force airplanes and missiles. We know we can build a nuclear-powered airplane. Sometime within the decade you will see it flying."*

O. B. FALLS JR., MARKETING MANAGER, GENERAL ELECTRIC ATOMIC PRODUCTS DIVISION: *"If there is one lesson which history has taught us . . . it is to make no little plans, but to be bold and to reach for long-range and seemingly impossible goals."*

DR. A. M. ZAREM, STANFORD RESEARCH INSTITUTE: *"The age of the robot is before us . . . These devices will not merely replace human labor. They will free us to develop new industries, to attack more problems, and to bring about broader opportunities and a higher standard of living not dreamed of by our fathers."*



Policeman files the records of students attending the District of Columbia Traffic School.

'Reform' School Cuts Traffic Toll

Washington sends careless drivers to safety class instead of to jail. Result: a graduate's first offense is likely to be his last.

By Ernst Behrendt

THE average driver in Washington may never have heard of the District of Columbia Traffic School until the day he finds himself answering a summons for exceeding the speed limit or passing a red light.

Waiting his turn in court he mentally rehearses the little speech he has prepared for the judge: "I didn't mean to go faster than 30, really I didn't. But there was that other car . . . And, Your Honor, I've been driving a car for 20 years, and this is the first time . . ."

If the driver does not look like a hardened criminal and the record bears out his appearance, and if this is his first offense, the judge may tell the driver, in effect: "I'll give you a choice. I'll either judge your case on its merits. Or, if you prefer, you can attend traffic school and report back after you complete your test, in which case you may receive a suspended sentence."

The Washington Traffic School, one of the oldest of a kind that is being set up in more and more cities, was founded in 1948. Since then, more than 25,000 men and women have attended its

"ROAD TEST": Student in Washington traffic school manipulates automobile-type controls to meet changing driving conditions shown in a movie that he sees through the viewer.

courses. And only about 1,000 of them —one out of 25—have become "repeat violators." This compares with 60,000 violations in a single year (not counting parking tickets) among all the 350,000 drivers licensed in Washington—one out of every five or six.

Our average first-offender, faced with a choice between a fine or jail and going to school, quickly forgets his clever little speech and grabs the chance to leave the building with his official record unblemished. He may even be relieved when they tell him that the entire course in traffic school consists of three two-hour sessions.

But even so he is resentful: There were lots of drivers around who were going much faster. Why did the police let them get away and pick on him?

As they sit down on hard straight chairs in the classroom at 300 Indiana Avenue, in the Police Department Building, most of the 100 or 125 men and women still think that they are pretty good drivers: anybody can bump into another car. Just a piece of bad luck, that's all.

"Ninety per cent of those who come here are mad," says Sgt. Aubrey S. Yowaiski, one of the senior teachers in the traffic school. "They have a chip on their shoulder. They feel they have been driving for so many years that no one can

Attitude Training: Students view slides showing the tragic results of careless driving.

teach them anything more about it."

"They may be right, too," adds Yowaiski. "Truth is you can't teach anybody anything as long as he is mad.

"The trick is to get them on your side. Make them understand that you are there to help them undo habits which one day may kill them or others."

Two hours of laws and regulations—and "getting them on your side"—make up that first session. A week later at the second one: accidents and how to avoid them.

Again, the teacher avoids lecturing. He may begin by showing two slides—first of a sweet-faced little girl, then of a likable middle-aged man. The man is a taxi driver, married, two children. He has been in business for 13 years. He considers himself a good driver. He thinks he knows the rules although he has never really bothered to keep track of changing laws and he has forgotten some of the things he once knew. But he is smart. Once he talked his way out of a ticket for speeding. He knows his stuff. He always gets out of tough spots. In fact, he is such a good driver—he might even be you.

The men and women in the audience grin. They know that was a kind of left-handed compliment but they still grin. After all, it is true, isn't it: this cabby looks like a regular fellow, just like oneself in a kind of way. He's probably a good driver, and so am I . . .

Auto accidents cost more American lives every year than were lost in the three years of the Korean war.

The policeman whips out another slide, a picture of the little girl again. Only now it's her broken body, crushed under the taxicab. Killed by the taxi driver.

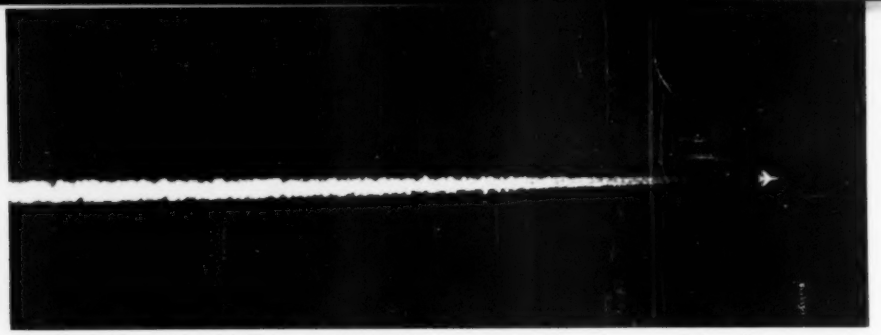
"Remember—that's the fellow who knows his stuff. Who always gets out of tough spots. Who is, in fact, such a good driver that he might be you."

"You"—the word lingers. The word gets them. The pictures get them. They sit there—housewives, clerks, businessmen, Government employees—some of them are crying. Some of them have children themselves, maybe a little girl just about that age.

More pictures, more slides, more stories that drive home the message: "Good driving doesn't happen, good driving is made. You've got to learn how it's made. You've got to learn the skills, the laws, the attitude of a good driver—or that same thing may happen to you."

TEACHERS in Washington traffic school are all policemen in uniform. On platform at "graduation" are (left to right): Lt. A. Osterman, Sgt. A. S. Yowaiski, Ptl. C. E. Humphries.

By the third session—the third week only—these are not the same people. They know now that this is not "a form of punishment" but the lesson that may save their own lives. This time they are taught what attitude means—obligations toward oneself and everybody else. There is a question-and-answer period and a panel discussion. And then they take the test—just 20 true-or-false questions. Practically all who can read or write pass it easily. END



The record-breaking F-100C, at 40,000 feet, crosses a wire strung not far above camera.

Fast Telescopic Cameras Time Jet in Record Flight

When Col. H. A. Hanes flew a Super Sabre over an 11-mile course at 822.135 m.p.h., two cameras with telescopic tracking sights proved that he had set the world's first official supersonic speed record.

Wires were stretched horizontally a few feet above the cameras, which were pointed straight up at each end of the course. The camera that photographed the jet crossing the starting wire triggered an electronic counter, which cut off as the other camera shot the plane crossing the finish wire.

Each recording camera had a 40-inch lens.

Planes "Fly" One Piece at a Time in New Aircraft-Testing Lab

The B-66 bomber cockpit at the bottom of this tank is one of many plane sections and systems that are rigorously tested before actual flight, at Douglas Aircraft's new lab in Long Beach, Calif. The sealed cockpit will be pressurized with water, and the tank flooded, to duplicate pressure differentials encountered in high-altitude flights.

No Gearbox, No Clutch, He Goes by Prop

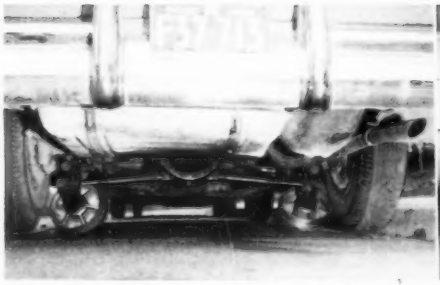
OVERCOMING "low-altitude drag" with a push propeller geared to a Ford V-8 engine, Clifford Robins pilots his homemade motor car along the roads of Yeovil, England, at a top speed of 70 m.p.h.

Robins, a grocer, used no rear-axle drive, no gearbox and no clutch. He estimates that the car cost him £200 ($560).

Big Sidecar Will Tote a Small Crowd

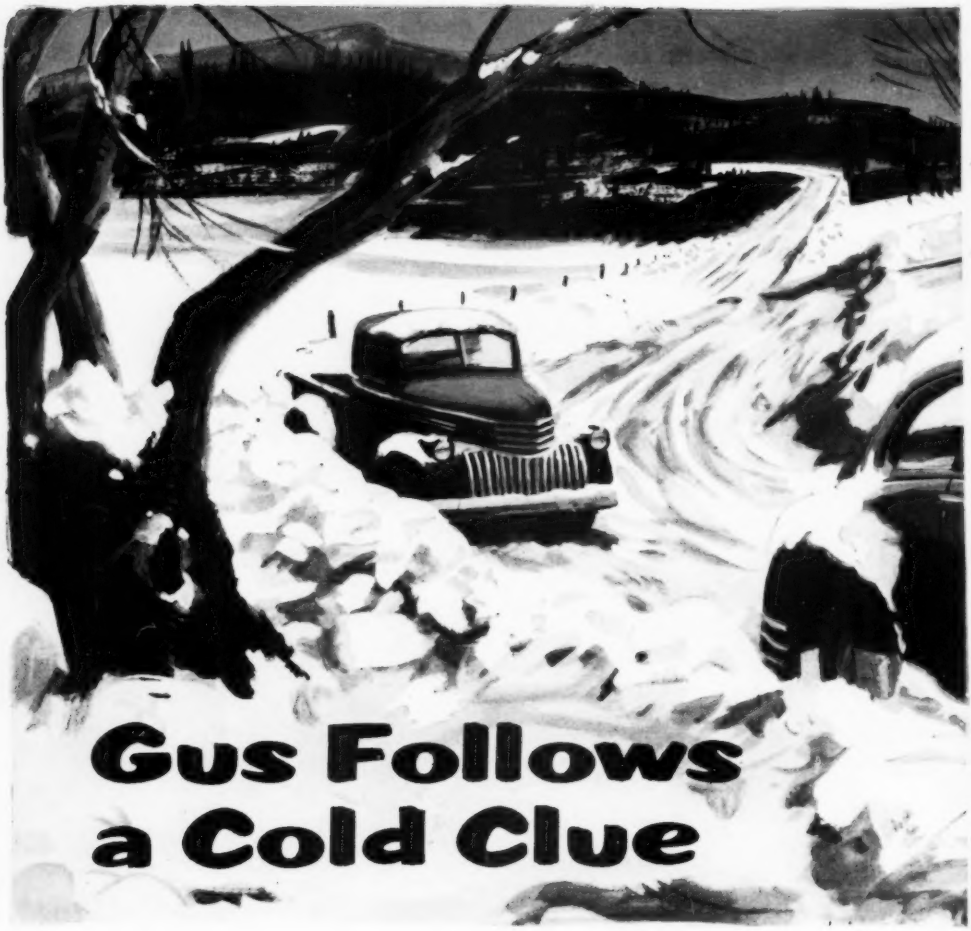
AN OVERGROWN sidecar turns this motorcycle into a family affair. Put out by a London manufacturer, it's a snug fit for five: three adults in the sidecar itself, and two on the motorcycle.

A roll top and hinged windshield (with twin wipers) can be opened for air.



Power Parking Rolls Car to Curb or Jacks It Up for Tire Change

HIS own parking idea—front-end first—lets C. P. Farr of Toronto squeeze his Buick into a space with only five inches to spare. Working off the power-steering hydraulic pump, parking wheels (left) lower and one wheel contacts the right tire. It turns when the engine is accelerated and swings the rear to the curb. Reversing moves it away for backing out. Either parking wheel can be used as a jack for changing a rear tire.



Gus Follows a Cold Clue

By Martin Bunn

GUS WILSON was returning to the Model Garage after a welding job at a farm several miles from town. A brisk wind was drifting snow into the ruts of the road and Gus's pickup truck was having heavy going of it.

Three more miles to go, Gus thought with relief, and he would be back on pavement again.

At that moment, as he rounded a turn, he saw a stalled car in the road before him. Amos Miller, who ran the Mountain View Dairy, was prying at the rear axle with a long stick of timber.

"Looks like you forgot your jack, Amos," Gus greeted him, coming down from his truck. "Nasty weather to have a flat tire."

"Got a jack," Miller grunted, heaving up on the timber, "but the danged thing won't work. Lend a hand, will you? Me and Ma—"

"Amos!" Mrs. Miller called from the car. "How much longer are you going to fuss around there? You've been two hours fixing that tire. Land sakes . . ."

"Gus Wilson," Mrs. Miller said sternly, "you fix this car to run, right away."

"It's all right now, Ma," Miller called. "Gus Wilson's here."

Gus got a jack and shovel from his pickup truck. He had the flat off Miller's car and the spare tire mounted in a matter of minutes.

"There you are," he said. "Now you're all ready to roll."

SOMEHOW Amos Miller seemed a ludicrous figure as he got into his 1948 Chevrolet sedan. He was clad in a neatly pressed overcoat which had been in style way back in the Coolidge era, topped by a battered hat, and bottomed by four-buckle overshoes which had waded through many a cow stall. The coat fitted his lean, broad-shouldered frame a mite too quick, and his large, work-worn hands dangled from the sleeves.

"Me and Ma," he said as he stepped on the starter, "have right important business in town today. We're much obliged to you, Gus."

"I declare," Mrs. Miller said, busily brushing the snow from her husband's coat and straightening his tie, "it's lucky

we started early to do some shopping."

"Glad to help," Gus said, but his ear was cocked to the grinding of the starter.

"Ding it!" Miller snorted. "Now can you beat that. Looks like she ain't going to start."

"Probably just cold," Gus told him, getting into his pickup. "Put her in gear, Amos. I'll give you a push."

Gus managed to push the Chevrolet a few yards in gear. Then, with spinning wheels, the rear end threatening to slue into the ditch, he could move it no farther in the snow.

"It should have started," he told Miller, moving to lift the hood. "Maybe it's gathered some condensation."

"Sorry, lady, but you're blocking this driveway."

Gus got out his tool kit, removed the distributor cap, critically inspected it and wiped it out with a dry rag. He removed the plugs, cleaned them and set the electrodes at .040 gap. He checked the ignition points for surface, alignment and proper setting, pulled the high-tension wire from the coil, held it within a quarter-inch of the motor block and snapped the ignition points with his thumb. A fat, blue spark jumped the gap with a snapping sound.

Coil and condenser seemed all right, Gus mused, as he made a quick check of ignition timing and inspected wires for loose connections and breaks.

"No reason she shouldn't start," he told Miller after he had replaced the parts. "Try her now."

MILLER ground on the starter without result. Gus, realizing that he could have a hot spark at the end of the coil wire and not at the cylinders, ran a neon-tubed screwdriver along the plugs. All seemed to be firing.

"Better take it easy on the battery, Amos," he cautioned.

"But why don't it start?" Miller demanded. "Seemed to be running all right when I shut it off to work on the tire."

"It's *got* to start." Mrs. Miller's eyes were wide with concern. "We're meeting the train from New York, Gus. If we're not there, that poor child will feel unwanted."

"Child?" Gus asked, knowing that the Millers were childless.

"We didn't want to tell folks," Mrs. Miller said, and in her eyes Gus beheld an expression of tenderness and joy, "until we were sure. Amos and I have arranged to adopt a war orphan from England. We've never had any children of our own. He'll be here today."

"Harumph!" Miller said, getting out of the car to stand there in his too-tight pants. "Foolishment, if you ask me. But Ma had her mind set on it, and when she gets her mind set, Gus, she's—"

"Ha!" Mrs. Miller snorted. "And who, Amos Miller, has been on pins and needles about it for months, shining things up, and all?"

"Well," Miller said sheepishly, "I didn't want the little feller to come to America and find us living like hogs in a pen. The barn needed painting, anyway."

"I see," Gus said. He glanced at his watch. "That train is due in an hour."

"Gus Wilson," Mrs. Miller's tired features were stern now, "you fix this car to run, right away."

"Yes, ma'am," Gus said, grinning. "Since I can't push you or get around to tow you, I guess I'll have to do just that."

"Tow us!" Miller exclaimed. "That wouldn't be right. We aim to drive up to the depot in style."

Queer, Gus thought, as he shoved his shoulders under the hood. He'd always thought Mrs. Miller was a bit on the homely side. But when she was speaking of that kid, she'd seemed almost beautiful. They didn't have much time, he thought. It would take them 15 minutes

[Continued on page 246]

MECHANICS
and
HOMEBUILDING

Is your home still in the Dark Ages?

Make These Modern Lighting Fixtures

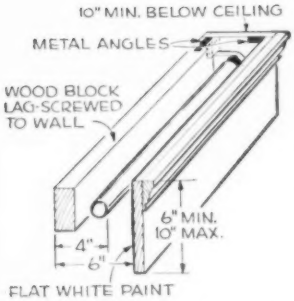
By Sheldon M. Gallager

MODERN lamps are not expensive if you build them yourself. Nearly all fixtures are made of standard parts that are available through local lighting and electrical stores.

The sliding traverse lamp above, for example, consists of a ceiling-type curtain track, some brass weights and a standard wind-up cord reel. Lamps such as this sell for up to $80, but you can make one like it for less than $15.

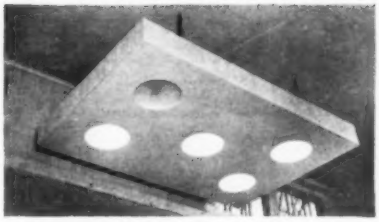
By assembling your own lamps, you

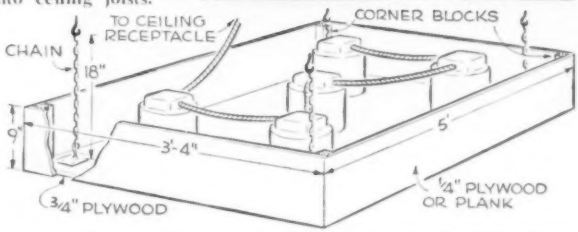
Your Living Room Needs Three Kinds of Light

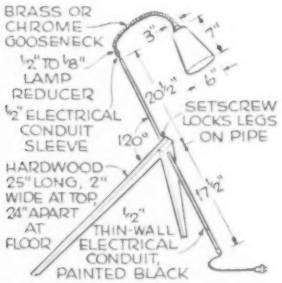


LIGHTED VALANCE bathes entire wall, makes rooms look larger. Mount fluorescent fixture on a wood block lag-screwed to wall to set it out over curtains (a two-by-four will usually do).

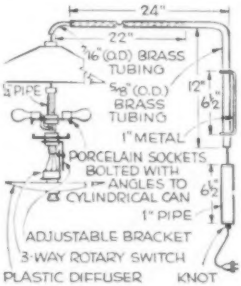
DROP FIXTURE hides old overhead socket and lets you use modern recessed lights without cutting into ceiling. Buy metal lamp housings, then cut holes in plywood panel to match mounting rings. To carry weight, screw hooks into ceiling joists.



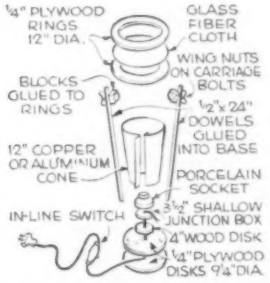




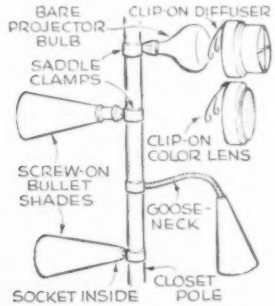
GOOSENECK, available at lighting stores, spots light for reading or close work. Squeeze reducer into conduit sleeve, hammer both into conduit, then thread gooseneck into reducer.



WALL LAMP swivels, telescopes and moves up or down to cover several areas. For a two-bulb lamp, substitute ready-made S-type fixture. Adjust counterweight by trying pipe lengths.

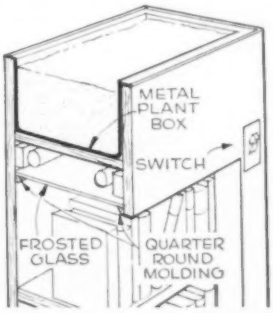


TILTING REFLECTOR gives direct light for reading, indirect for TV viewing. Brad two plywood pieces together for jigsawing the circles and rings. Use 150-watt projector flood lamp.



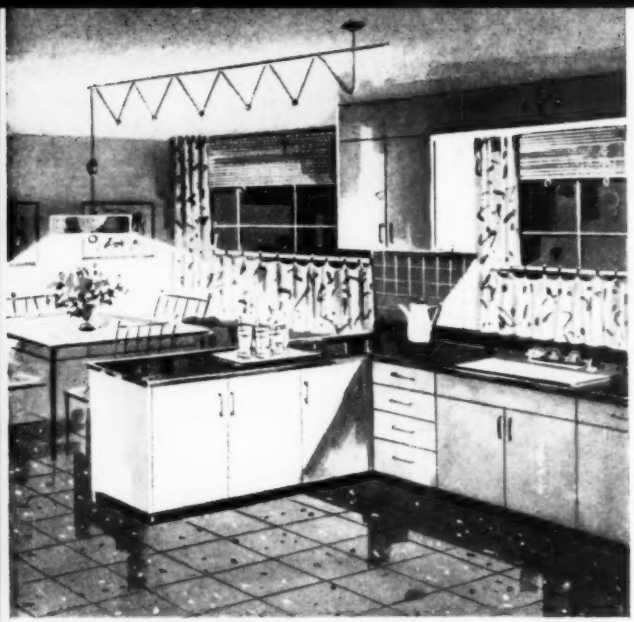
SPOTLIGHTS clamped to poles highlight plants, pictures, other decorations. You can use projector lamps bare or in "bullet" shades. Red, blue, green and amber lenses clip on.

CORNICE lights a glass or plastic room divider, makes a ceiling look higher. Lightweight fluorescent tube and face board can be hung from toggle bolts without your locating joists.

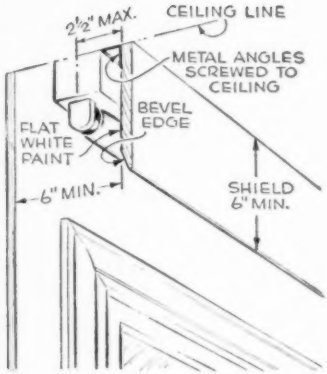


GLASS-BOTTOM SHELF lights books and knickknacks, brightens up dark alcoves. Screw one fluorescent tube to wall, one to inside of face board. Strips of molding support frosted glass.

Please turn the page for more on modern lighting



Lighting tips for kitchen-dining areas



OVER-SINK LIGHT knocks out the shadows that housewife casts when kitchen is lighted only by center ceiling fixture. Use a valance-type arrangement if there's a window, or screw fluorescent tube directly to ceiling as at right above. Traverse lamp shown at bottom shuttles from a work counter to a breakfast nook, or between the living room and the dining area.

can not only save money but also tailor them to fit your particular needs. Today's trend toward "open" living and multi-purpose rooms calls for flexible fixtures that serve more than one purpose. A track lamp is often used to light a living room, then slide into a dining alcove. Spotlights are placed where they can be swiveled to illuminate more than one section of a room.

No wiring required. All of the fixtures shown here were designed to show what you can do without disturbing the basic wiring in your home. They can be plugged into existing outlets or connected to existing junction boxes.

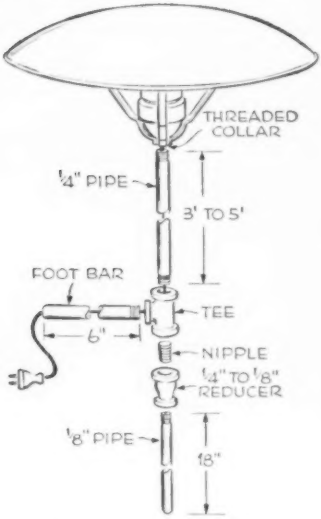
How to build a sliding traverse lamp

WIRE FIXTURE FIRST, threading thin rubber-covered cord through arms before attaching thicker cloth-wrapped supporting cord. Flat, S-type fixture shown is ideal for shallow drum and cone shades. Solder wires to take strain and tape them.

MEASURE CORD from ceiling to lowest lamp position and install reel "egg" midway between. Wind up spool, thread cord through hole in center, and the cord will roll itself on. Eggs take about 5′ of wire, are available at electrical-supply stores.

LAMP TRAVELS along ordinary ceiling-type curtain track screwed to joists. Tie cord to sliders with string or thongs (wire will cut insulation). Thread standard brass weights on the cord and form loops that hang down about 10″ or 12″.

Build these portable outdoor lights



SPIKE-TIPPED YARD LIGHTS can be stuck in the ground anywhere, don't need permanent wiring. Ready-made fixtures screw onto ordinary plumbing pipe, topped with plywood squares (above) or a commercial shade (left).

Wall and ceiling fixtures are becoming fashionable again. If you have an older home, from which chandeliers and wall brackets have been removed, you may already have convenient sources of power that will save tearing holes in plaster or fishing wires throug . walls. If you don't, you can often sneak cords down behind drapes, inside of built-ins, or use fixtures that make a decorative feature out of the cord instead of trying to conceal it. (Electrical codes, however, do not permit long runs of cord or permanent stapling in place.)

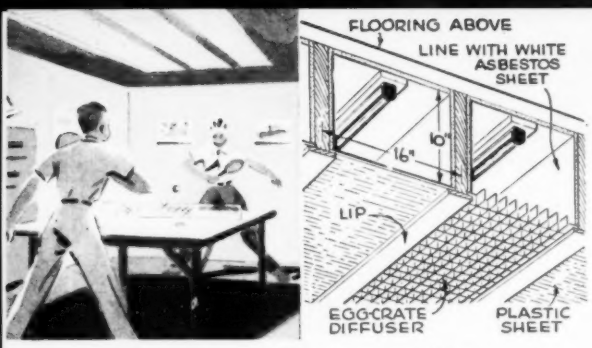
Connecting a terminal box. Wiring a new fixture into an old ceiling or wall

How to make a hanging tree lamp

KITCHEN COLANDER forms lower reflector, shedding some light downward through perforations. To remove the feet and handles, rest the rivets in the hollowed-out tip of a stick and drill them out. Paint inside white enamel, outside a dark green.

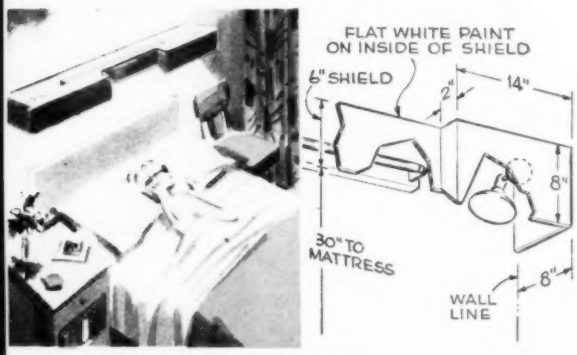
SALAD-BOWL SHADE is fitted with adjustable lamp harp through hole in center. Nut holds colander on threaded lower tip. By varying depth of harp, you can direct light outward or down. Paint inside of bowl pinkish-tan for soft light.

CORD IS FED through ⅛" brass lamp pipe, bent to hook shape to hang over tree branches. Have lower end threaded and screw it through bowl into lamp harp. Use a bowl 12" to 16" in diameter. Colander should be 4" to 6" smaller.



A luminous playroom ceiling

RECESSED FLUORESCENTS can be run between joists in cellar or attic, wherever the ceiling hasn't been finished off. For brighter light over game areas, leave tubes exposed or fit in "egg-crate" louvers that shield eyes without cutting illumination. You can also use twin-tube units to increase light.

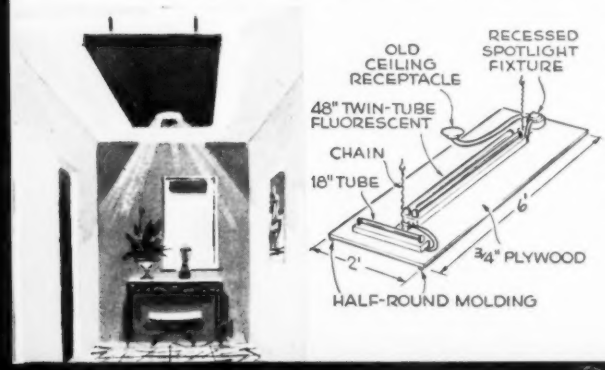


Take a sunbath in bed

COMBINATION BED LIGHT has fluorescent tube in center for reading. Wider portions at the ends house swivel sockets for sun lamps. Because of heat, line the wall and end sections with asbestos sheet and be sure to ask for special heat-resistant sockets. Do not use the lamps near curtains.

Light up a dark hallway

ONE DIM HALL LAMP can power a whole string of lights this way. Mount fluorescent tubes on panels of plywood (about ⅔ width of the hall) and hang from short lengths of chain or pipe screwed to the ceiling. Set a short tube crosswise at each end or add a recessed spotlight for dramatic effect.



Add these extras in other rooms

terminal box is easy and safe if you keep several points in mind.

First remove the fuse that affects the circuit that you're working on. In most cases, inside the terminal box you'll find two unconnected leads—a black wire and a white one—that ran to the old fixture. Connect the white wire from the new fixture to the old white wire and the new black one to the old black one. Never cross black and white leads.

If you find white and black wires connected, this indicates a separate leg running to a wall switch (the only exception to the black-and-white rule). Leave these connected and use only the two free wires. Use twist-on, solderless connectors, but don't bare too much of the wire, so that the connectors will fully cover the exposed metal.

Use matching hardware. Lamp parts are standardized to fit two sizes of pipe thread, ⅛" for most common fixtures, ¼" for some larger ones.

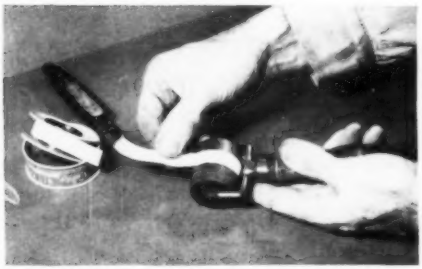
If you have to connect a larger size lamp part to a smaller one, use a reducing adapter. Nearly all sockets are threaded to take ⅛" pipe and thus require an adapter when they are connected to ¼"-thread fixtures.

Cord reels, called "eggs," are now available for about $4. You can also get precoiled cords for drop lamps that move up and down like a coil spring.

For fixtures that hang by their own cords, use the heavier cloth-covered wire instead of the common rubber-covered type. Be sure to knot the cord inside the lamp and at the ceiling box to take the weight without straining the connections. END

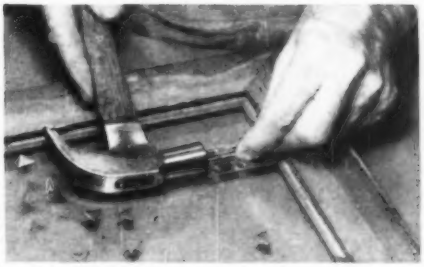
Rail Protects Picture Window Against Bumping by Chair

Do you wince every time a chair is backed against a picture window? A board or piece of molding padded on the glass side and attached at chair-back height across the window will absorb any careless blow. Finish the board to match woodwork.



Taped Roller Leaves No Dents

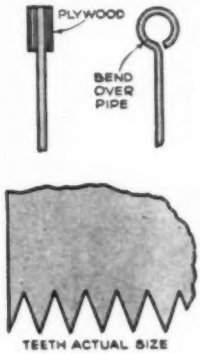
If a seam roller leaves an impression on wallpaper, soften the roller's surface with a single thickness of medical adhesive tape. Butt the ends for a smooth connection.



Hinge Sets Glazier's Points

You can drive glazier's points into window sash with a small butt hinge. Fold it into an L and hold it by one leaf. Keep the hammer head flat and slide it on the glass.

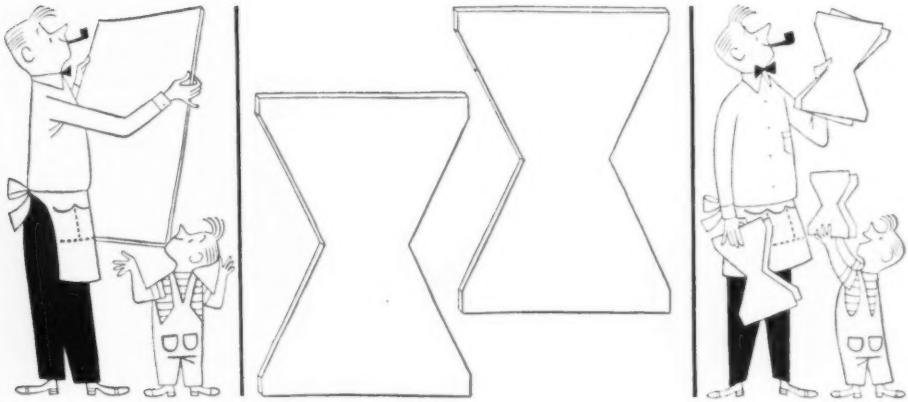
Notched Piece of Scrap Spreads Glue Evenly on Flat Surfaces

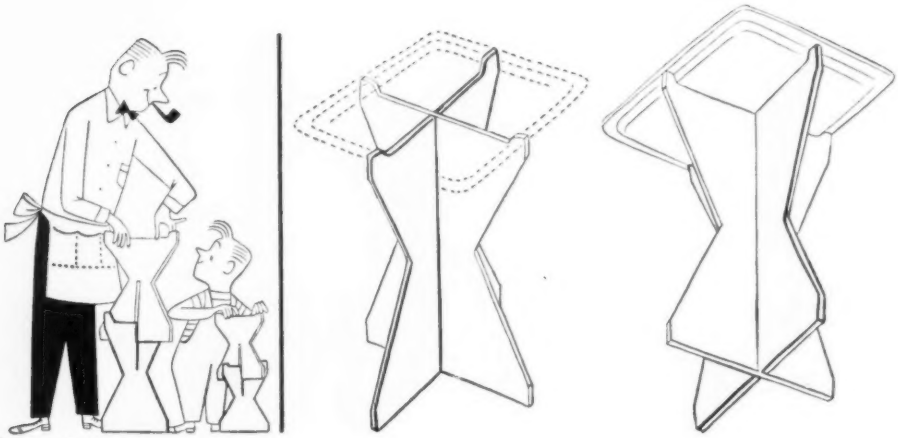


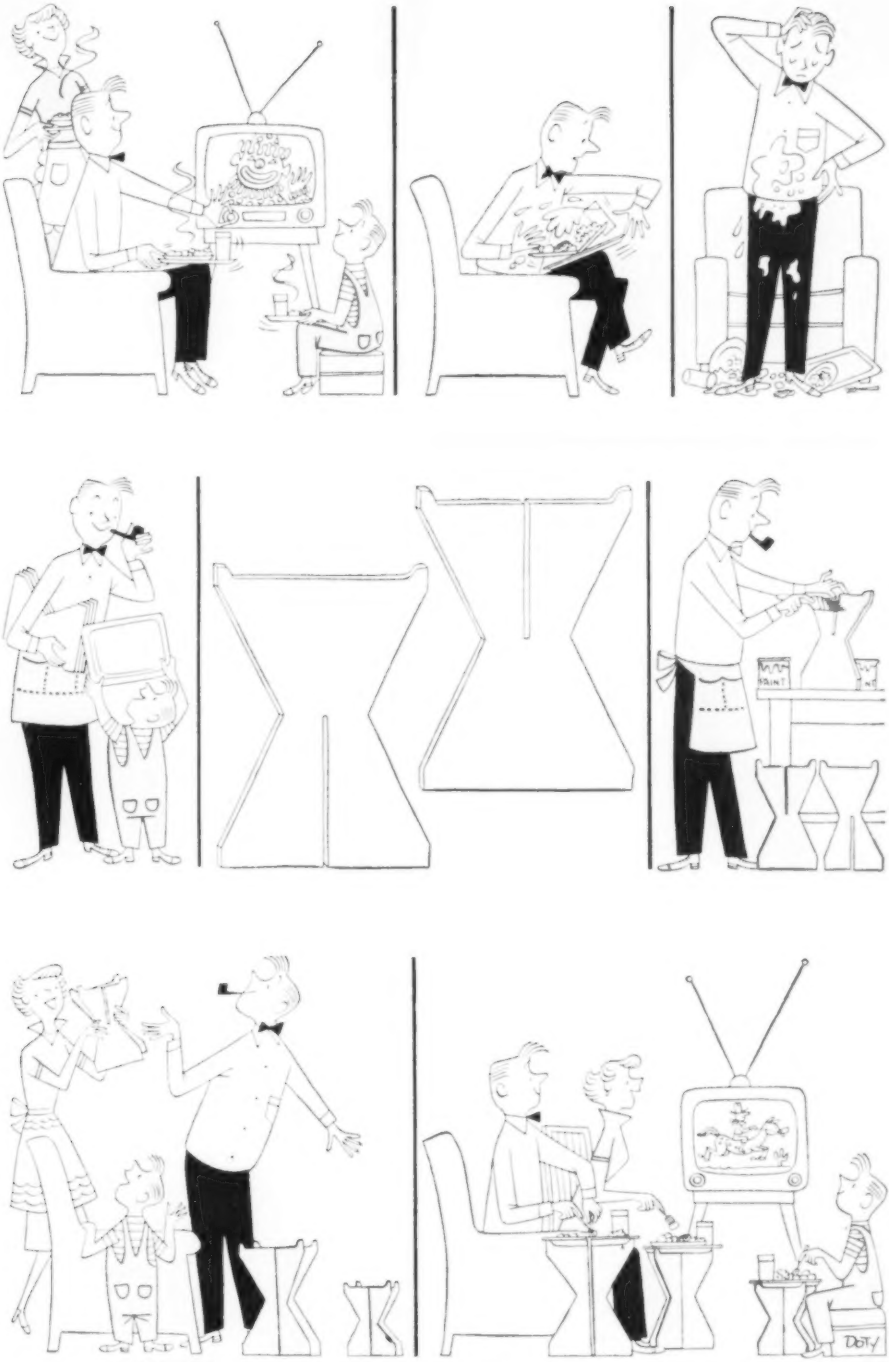
Notch one edge of a piece of scrap plywood, hardboard or sheet metal; it makes a fine tool for spreading glue on flat surfaces. For a handy grip, bend the metal opposite the notches around a piece of tubing, or tack strips to the wood or hardboard.

By Roy Doty and Arthur R. Tanner

Wordless Workshop







Next Month: A wheeled storage cart to collect toys quickly

Prefab It Now for Spring

Get a jump on the season by doing outside work inside now.

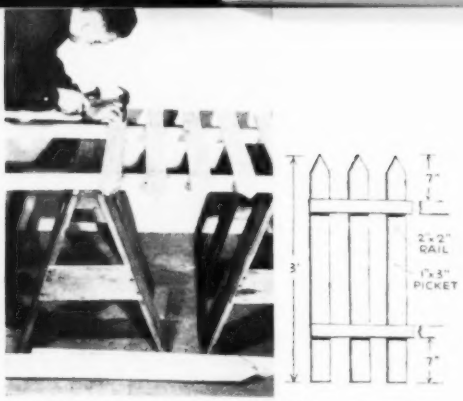
By William Gilman

HERE is a sure-fire recipe for making those outdoor improvements that you never get around to when the lawn-mowing and gardening season starts. This method will:

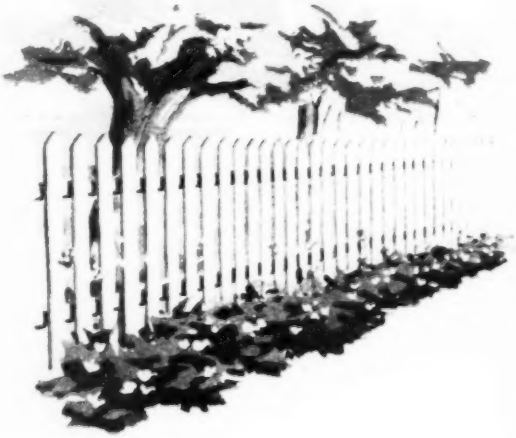
- Give you more daylight hours for other chores next summer.
- Enable you to shop for lumber and other materials before the spring rush.
- Utilize your spare time to advantage right now.
- Turn you a profit if you care to do the same for others.

The dodge is simple—you prefabricate the basic parts of lawn and garden projects in your basement, workshop or garage on winter evenings and weekends, when you can't work outdoors anyway. Come spring, they're all made, and ready to install with a minimum of effort.

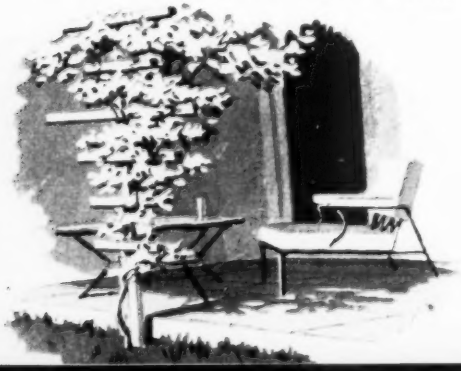
Here are five examples of things you can undertake on a prefab basis. You can probably think of others. There's only one must: start right now.



A NEW FENCE. Whether it's a picket or some other type, you can build it in 8' sections and paint them ready for nailing to posts when the ground can be dug. Now is the time to treat the posts with preservative too. Drawing shows the dimensions for a typical picket fence.

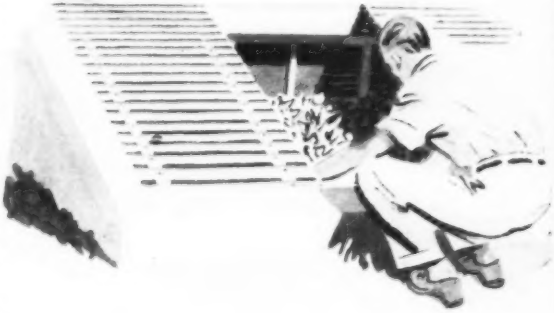


GARDEN TRELLIS. Nail furring strips to a two-by-four post for the simple style shown. Fancier ones are a little harder to make. You can paint them now for quick installing next spring.

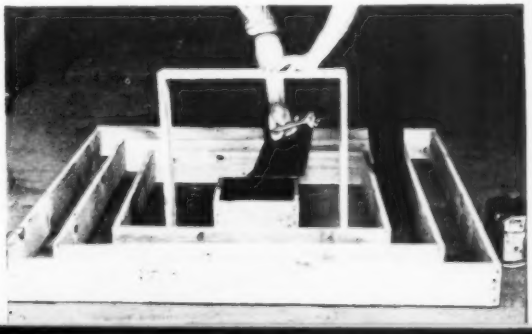


COLD FRAMES OR LATH HOUSE. Make lath panels to a standard size such as 3′ by 6′. Nail the lath, its own width apart, to ends of one-by-three stock. Painted, the panels are ready to nail up as walls and roof of a lath house or potting shed or to hinge over propagation beds.

FLAGSTONE WALK OR PATIO. Make flagstones now, and you won't be waiting for concrete to set next spring. Place oiled wooden form on roofing paper, pour in a mix of 1 part Portland cement, 2½ parts sand, 2½ parts gravel. Two hours later, you can lift off and re-oil the form for another casting. Set in a diagonal strip to make two triangular slabs. To tint, add dry color.



NESTING FRAMES. Use these for flower or rock gardens, or to grow strawberries or vegetables in tier fashion to save space. Saw one-by-six common pine or similar lumber to make frames from 1′ to 3′ square. Nail the corners together. Coat with asphalt paint or other wood preservative to lengthen the life of the frames.



Feather Edge on Wallpaper Patch Makes it Invisible

TEAR, rather than cut, a wallpaper patch to cover soiled or torn areas. The resulting feather edge, when pasted down, makes the patch barely noticeable. Tear in a random shape, lifting the "good" part upward so that tear edges are feathered inward.

Marble Checks the Floor Level

WHEN you're inspecting a new house, place a marble on the floor. If the marble rolls easily, it indicates uneven settling of the house, perhaps insufficient framing—and trouble ahead.

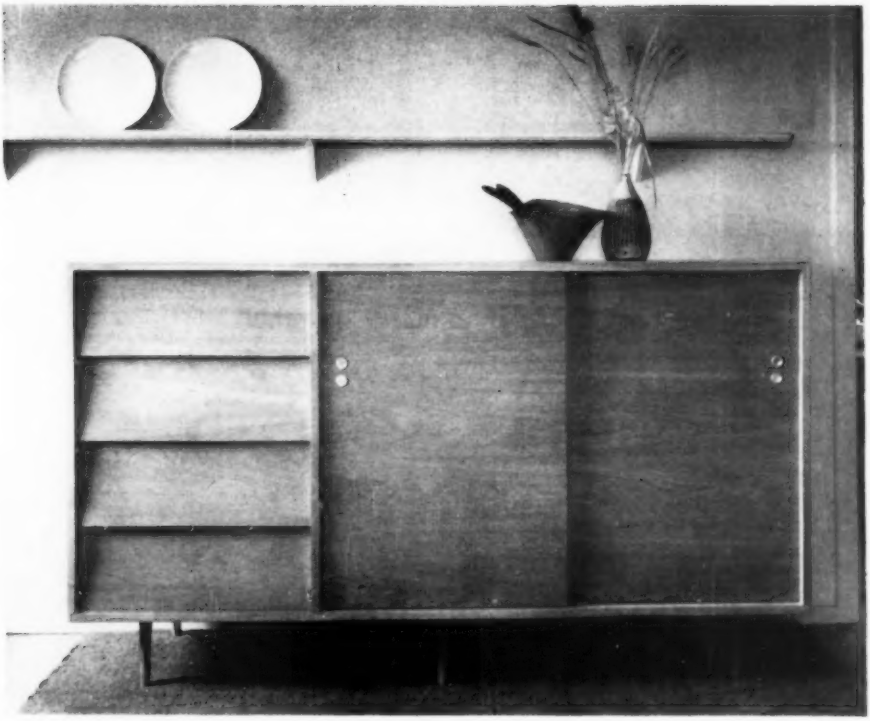
DO IT THE EASY WAY

TIRED OF POLISHING BRASS? Next time you do it, give the item a quick dip in thinned clear shellac. A dowel will support a doorknob for easy dipping and drying.

A SUBSTITUTE FROG for arranging flowers in a low bowl is right at hand in most kitchens. Use a plastic scouring pad.

NEED A STOP to spill-proof a drawer? Use a mending plate (or flatten a corner angle). Screw it inside the drawer.

CHIPPING AWAY HARDENED GLUE from a woodworking project is difficult. Remove it easily by first softening with vinegar.



How to build a good serving chest

Efficient storage and fine lines meet in this buffet that an art museum honored.

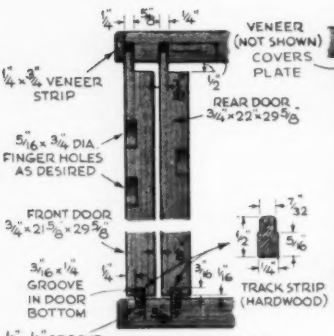
By Frank Dorr

YOU settle for nothing less than the very best when you build this buffet. It is beautiful enough to rate showing in an art museum, which it did. The Museum of Art in Newark, N. J., displayed it as an outstanding example of contemporary furniture design.

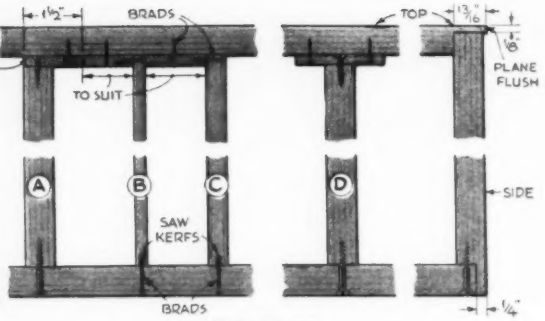
You'll notice the clean lines, uncluttered by jarring hardware. You'll find an interesting pattern of shadows from the slanted drawer fronts (which also provide built-in pulls). You'll see the simple joints—plain exposed rabbets—typical of fine old Colonial and Shaker furniture.

And you'll enjoy equally its practicality. The buffet will hold all of a family's dining equipment. There are four drawers—one compartmented, one lined

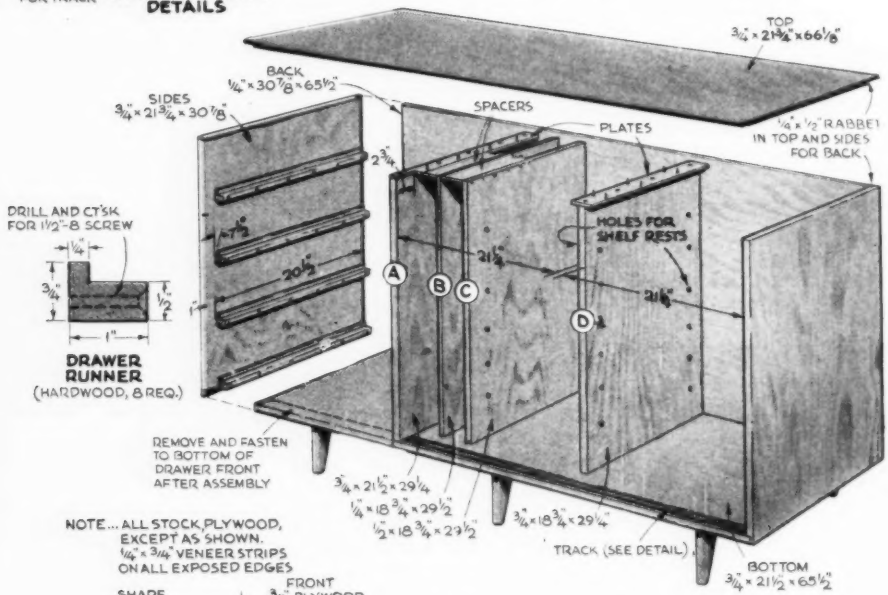
Here's how the buffet looks with its companion chairs and table, all designed for PSM by Martin Stan Buchner of Whippany, N. J.



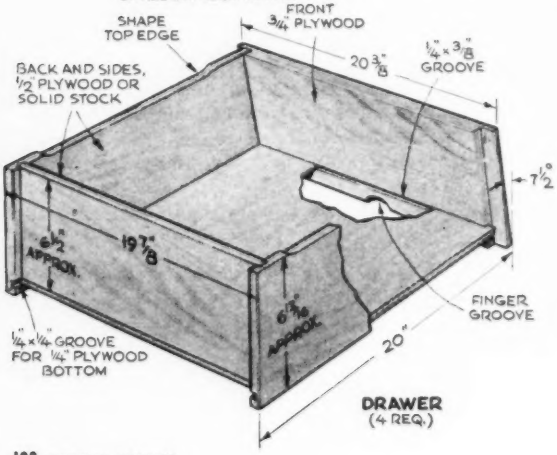
TRACK AND DOOR DETAILS



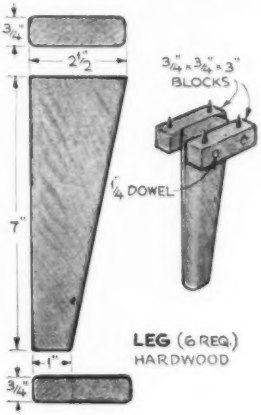
JOINT DETAILS



NOTE... ALL STOCK, PLYWOOD, EXCEPT AS SHOWN. 1/4" x 3/4" VENEER STRIPS ON ALL EXPOSED EDGES



DRAWER (4 REQ.)



LEG (6 REQ.) HARDWOOD

1 VENEER FRONT EDGES of top, bottom and sides after cutting track grooves but before rabbeting ends. Edge of drawer-compartment partition is veneered after you attach fastening plate.

2 ALIGN SHELF-HANGER HOLES with a drilling jig having ¼" holes on 1½" centers. Drill through the central partition, which takes two hangers back to back, but not through the others.

3 ASSEMBLE CASE DRY, bottom up. Glue the bottom on, one end at a time; then invert and glue on the top. Use a bowed block under clamps to assure even pressure along the joint. Wedges between the clamp body and side of case apply gluing pressure to rabbet sides. Tack on the back temporarily to keep the case square.

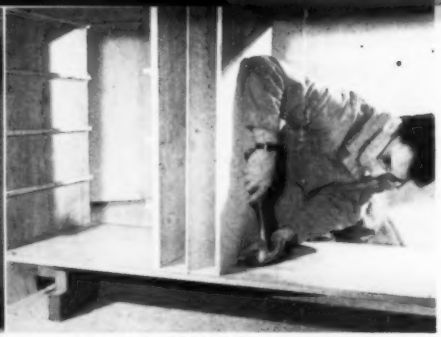
4 GLUE HARDWOOD DOOR TRACKS in previously cut grooves in bottom of case. Tracks are ¼"-by-½" hardwood with upper 3/16" narrowed to 7/32". Edges are chamfered. These fit grooves in door bottoms. Door tops have rabbets that slide in ¼"-by-½" grooves in top of case, which also are cut before case is assembled.

and fitted for your best silver. There are two vertical compartments for the trays and platters that you never could store conveniently. There are two sections with shelves that you adjust to fit your china and glassware. The height is just right for serving food—or showing off your wife's flower arrangements.

This is another piece of superior cabinetry designed and built just for PSM by Martin Stan Buchner. It matches the chairs (Nov., p. 178) and table (Dec., p. 184) to complete a dining room of truly fine furniture that amateur craftsmen can make.

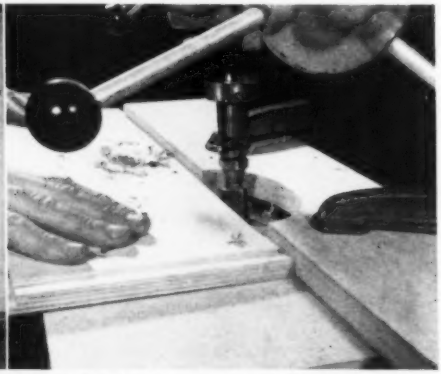
Has many uses. The buffet is what cabinetmakers call a "case," an all-purpose unit for any room in the house. It is detailed here for dining use, but slight changes in dimensions could make the

5 PLYWOOD FASTENING PLATES are screwed to top edges of two ¾" partitions, then screwed to top of the case (case is inverted here). Bottoms of these partitions are held by screws driven into their edges through case bottom.



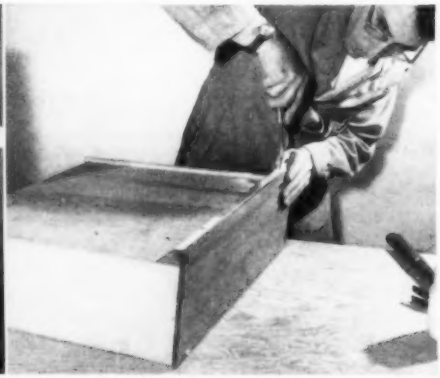
6 TWO THIN PARTITIONS are bradded to spacers at top (case is still inverted). At bottom, cut kerfs in partitions with a fine-toothed saw blade and slide them over brads driven through the case. This avoids nailing into thin wood.

7 POSITION DRAWER RUNNERS accurately with a jig cut to drawer height—one-fourth inside height of the case less the thickness of a rabbeted runner. Rabbet the runners in long strips on table saw, then cut strips into finished length.



8 RECESS in the top edge of the drawer side is made on the drill press with a shaper cutter. If you have a concave cutter, it will put a neat finishing roll on the edge. Use a clamped fence having a semicircular cutout.

11 FOR BOTTOM-DRAWER GRIP, cut out a 1½"-deep section from the bottom of the drawer compartment. Use a keyhole saw, taking care not to mar the cut-out piece—you'll need it in a little while. Sand all the sawed edges smooth.



12 PUT BACK THE CUT-OUT PIECE, after recessing for finger grip, on the bottom drawer. Glue and screw it on to project ½" in front. Now you can get at the bottom drawer, yet the veneer line at case bottom remains unbroken.

same design into a bedroom chest, a radio-TV-phonograph cabinet or a living-room storage unit. Since it looks as handsome from the back as from the front, it provides an excellent room divider for a new open-plan home. (If you use it that way, you should make it with a hardwood-plywood back and veneer on the back edges.)

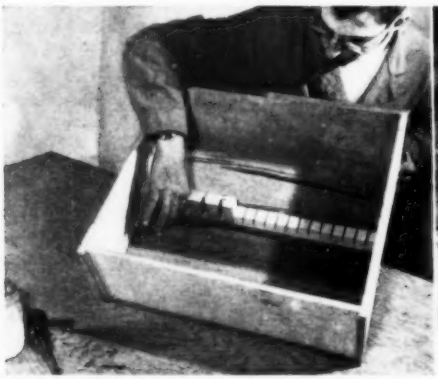
Materials. The buffet is almost entirely plywood, which makes a simple and sturdy job. There is no frame—the strength is in the parts that you see.

You need ¾″ hardwood plywood for the top, sides, drawer fronts and doors. The bottom, two partitions and shelving are ¾″ plywood that matches the hardwood-plywood inner face (this is usually birch). The drawer sides and backs are ½″ plywood or hardwood. The drawer bottoms, one tray partition and the case back are ¼″ plywood. The remaining partition can be ½″ or ¾″ plywood.

The only solid stock you need is ¾″-by-1″ hardwood for drawer runners, ¼″-by-½″ for door tracks, ¾″-by-2½″ for legs and

9 HIDDEN FINGER GRIP that lets you open the drawer is cut in the inside bottom edge of the drawer front with a ball cutter. Don't cut deeper than ½″ or you may mar the outer face. Don't recess the front of the bottom drawer yet.

10 ASSEMBLE DRAWERS with glue and fourpenny finishing nails. Notice dividers—¼″ plywood in front and back slots—in drawer at left. Try drawers in runners, and scrape off excess stock. Thumbtacks in runners fix loose fit.



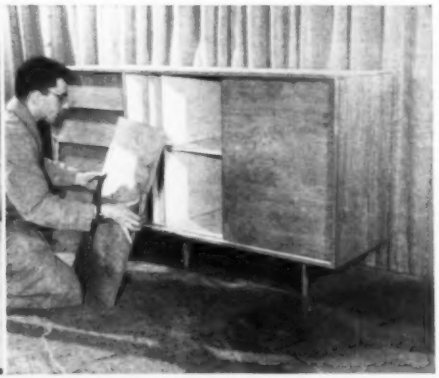
13 SILVERWARE RACKS, slotted on the table saw to suit the pieces you have, are glued into top drawer and screwed from the underside. Line the interior of the drawer with flocking, felt or tarnish-resisting silver cloth.

14 LEGS have a simple taper on one side. You can saw all six identically and quickly by holding the ¾″ hardwood in a jig having a notch cut to match the leg taper. Careful layout, depending on stock width, will reduce waste.

15 ROUND THE EDGES OF THE LEGS with a 3/8" rounding-over bit in the drill press. Safety pays on this type of operation: Clamp a wooden fence to the back of the drill-press table, even if your bit is fitted with a pilot tip.

16 LEGS ARE HELD by dowels running through into screw blocks, which are drilled and countersunk for 1½" No. 8 wood screws. Attach outer legs about 6" in from sides. Front legs go 1½" in from edge; back legs are flush.

17 ATTACH THE BACK PERMANENTLY with glue and brads after partitions and legs are assembled. The back fits top and side rabbets, overlaps bottom. Finish both sides of the back with sealer to prevent any warping.



18 DOORS SLIP IN. Push the rabbeted top up into the case groove, then lower the door so that its groove fits over the case track. Glue finger sockets in. When finishing the buffet, continue the outside stain 1½" into the interior.

¼"-by-13/16" veneer. You may be able to rip the veneer from left-over chair or table stock, but you'll need two pieces at least 66⅛" long each.

Cost. Like anything worth while, it's not cheap—fine hardwood-faced panels run into money. And for something as good as this chest, you may have to buy more wood than you'll immediately use, in order to get the most desirable grain patterns just where you want them. Still, you should be able to get away with somewhere around $100 for materials. For this you get a piece of furniture that is worth three times your cost.

Construction is a straightforward table-saw operation, with an assist from drill-press cutters. A friend standing by will prove helpful when you have to cut those big panels perfectly square. And you'll certainly need him during assembly, to turn the big case over.

The last step is slipping in the doors. Give them a push. Slide smooth? Quiet? That's as it should be. This is a fine piece of furniture. END

Folding Candelabra Suits the Occasion

DINNER-FOR-TWO or a big banquet . . . this three-part candelabra fits either setting. Fold it into a compact triangle or stretch it to a full 20″ as you wish. It's made of brass—sheet, tube and rod.

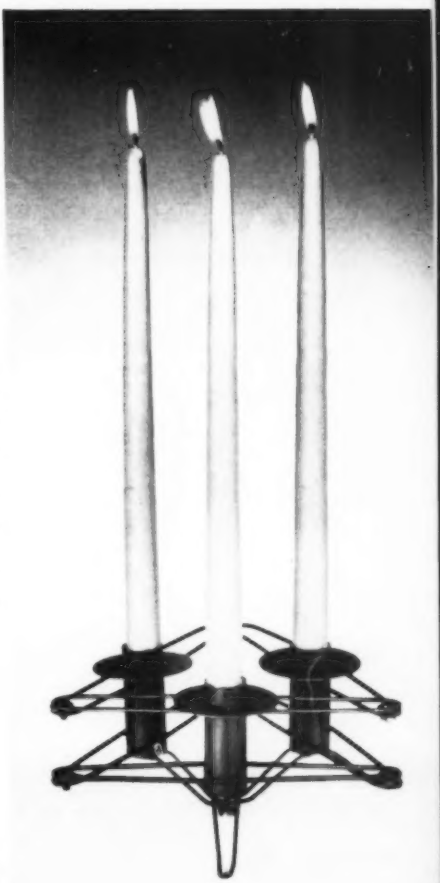
For proper meshing, the arms of the middle unit must be ⅛″ higher than those of its neighbors. Allow for this by sawing the middle candleholder 2⅛″ long instead of 2″, or shape the leg of the middle unit to stand ⅛″ higher.

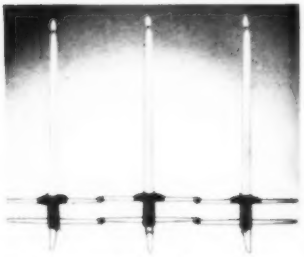
Remove the 1″ center from the drip rings with a circle cutter, hole saw or jeweler's saw. Cut the outer ring with tin snips. Also cut 1″ disks from $\frac{1}{16}$″ sheet brass for the bottoms of the three candleholders.

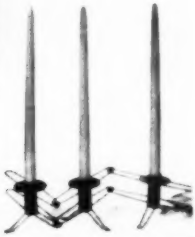
A piece of ⅛″ rod about 18″ long is needed for each arm, about 12″ of the $\frac{3}{32}$″ rod for each leg. Tight bends are easier if you heat the rods and quench in cold water. A small blowtorch gives ample heat.

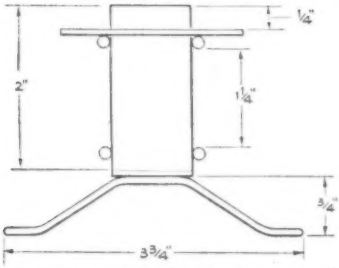
Clean the parts with steel wool and join with rosin-core solder. Nearby joints won't melt if you press a wet rag against them.

A coat of flat black will make the candelabra look like wrought iron.—*Bill Tyler, NYC.*

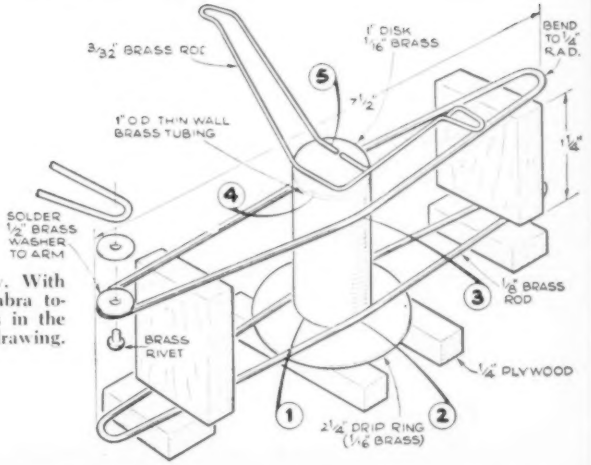






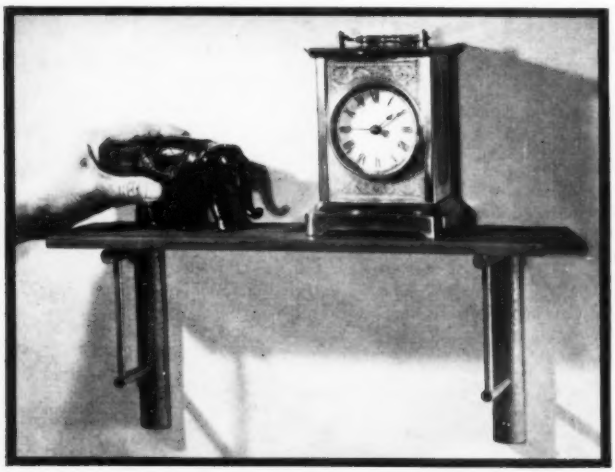


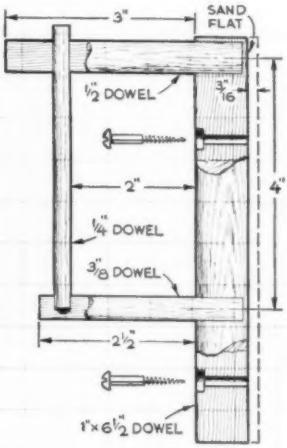
USE JIG at right to simplify assembly. With this plywood aid you put the candelabra together upside down. Solder the pieces in the order shown by the numbers in the drawing.



Home Projects You Can Complete in an Evening

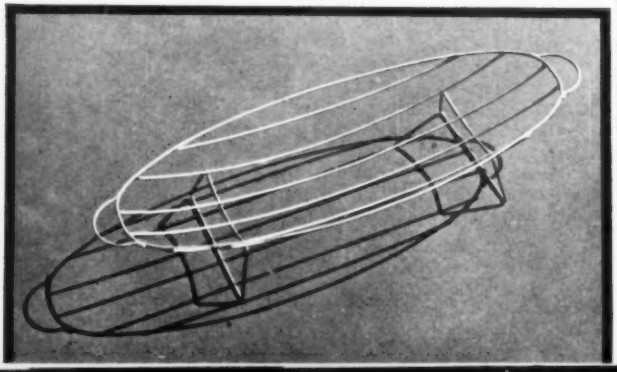
1 **Dowels are all** that you need to make the unusual shelf brackets below. Sand the 1" dowels flat along one side. Drill the ½" holes in these before cutting them to length. This will lessen the risk of splitting them by drilling near the ends. Drill and countersink two holes in each dowel for wall-mounting screws. Push the ¼" dowel into both of the horizontal dowels before driving these into the large one. Use glue and brads in all of the joints. Drill a blind hole in the underside of the shelf at each end to fit over the ¼" dowel of each bracket. Scrap plywood can be used to make the shelf.

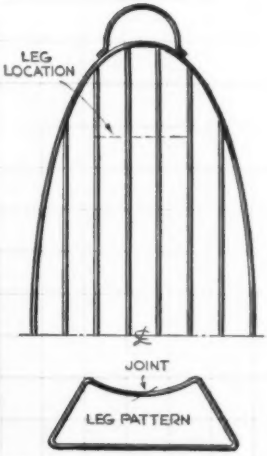




2 **Wire is smart** for home accessories, and this sleek fruit bowl makes the most of it. Scrape the insulation off heavy copper wire, or sand coat-hanger wire down to bare metal, and you've got the necessary materials.

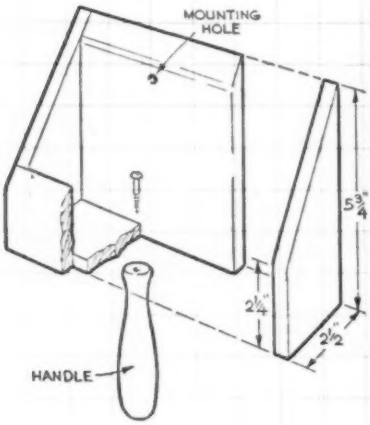
Draw the pattern full size on ½" squares as a guide for shaping the parts. Make the oval top first, filing both ends of the wire on a slant for a compact soldered joint. Thumbtack the oval to a board, cut the bottom wires to the proper length, spring them into place against the oval rim, and solder. Add the handle loops and attach the legs at a 10° angle.

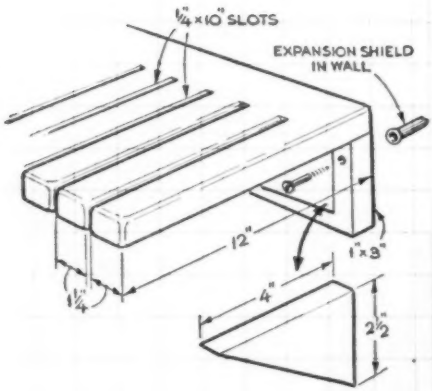




3 **Rolling bottle caps** and mislaid openers won't trouble you, with this permanent opener on the wall. Disguised as an antique wooden scoop, it catches every cap it removes. You can make it in less than an hour.

Use ¾" stock for everything but the back, which is ½" thick. Glue and brad the parts together. Mount a file handle with a single large wood screw through the bottom. Finally, attach an opener of the wall-mounting type to the back piece—*Sylvester J. Zuk, Troy, Mo.*



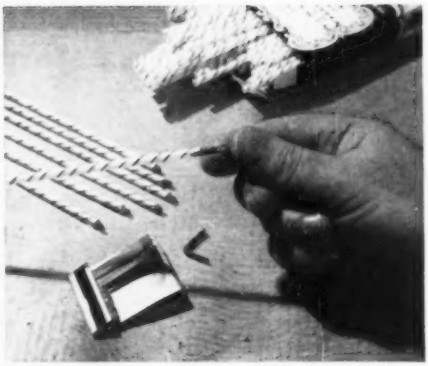


4 **Trousers slide in and out** of this slotted hanger. It has no clips to fumble with. Cut it from ¾" maple, birch or other hardwood. Round the corners of the slots and sand well, especially inside the slots, so that the cloth won't snag. Finish with wax or lacquer.

Screw the hanger to a strip with wooden braces, or you can mount it directly on the wall with 3" iron angle brackets. Shoulder height is just about right.—*M. C. Anderson, San Lorenzo, Calif.*

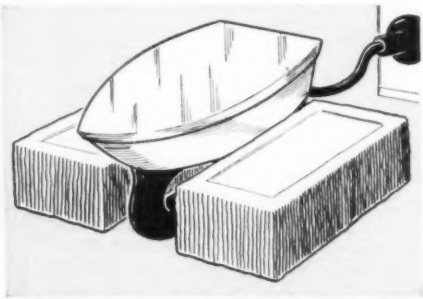
Box Stilts Give You a Lift

A CEILING plastering or painting job will be easier if you nail an old pair of shoes to two boxes of the same size and use them as stilts. Tie the laces tight so that you won't walk out of the shoes when you take a step. —*John O. Bock, Yakima, Wash.*



Soda Straw Lengthens Match

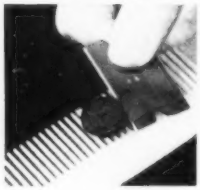
A DRINKING straw will put a long handle on a match for lighting fires or candles. Fold back the end of an ordinary book match and press the doubled part into the straw end. Hold near the tip when striking. With colorful wax straws, you can prepare a number of tapers and box them for a novelty gift.



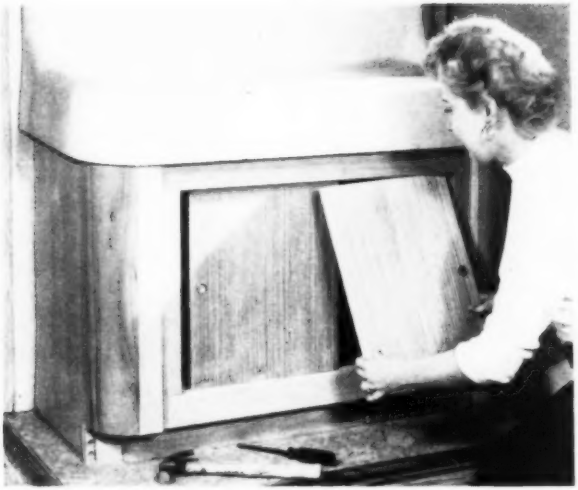
Iron Used as Emergency Stove

AN ELECTRIC iron propped upside down between bricks makes a good hot plate. We discovered this during last year's floods in Connecticut. Many flood victims used irons for coffee-making and light cooking when electric service was restored before gas.—*Arthur R. Morgan, Naugatuck, Conn.*

Comb Helps Button Removal



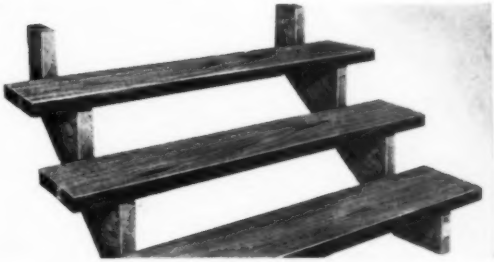
BEFORE taking a button off a garment you don't want to damage, slip a comb under the button to protect the fabric. Then cut the threads with a razor blade

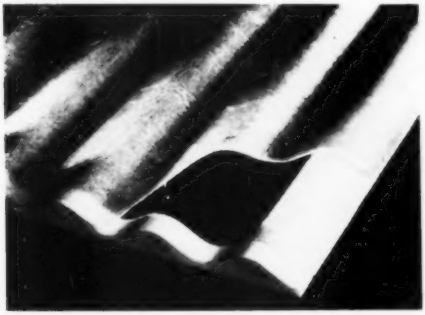


New for the Handy Man

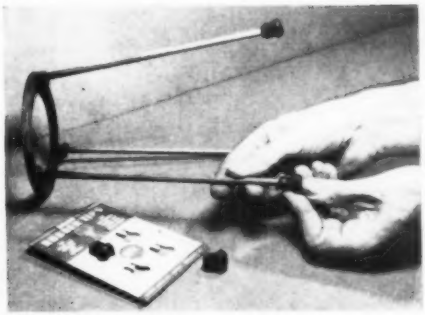
1. Sink Unit Fits Snugly. You can adjust the height and depth of this partially precut cabinet for an accurate fit under an old-fashioned kitchen sink. The ready-to-paint units come in standard lengths adjustable to minor variations. They are assembled by grooved joints and nailed to wall and floor through cleats.

2. Porch-Step Kit Saves Work. No sawing is necessary on stringers or treads in this replacement unit of two to five steps. Precut stringers carry 9½″ treads available in 3′ lengths and longer in multiples of a foot. Screw-type nails are provided and you can get risers as extras. All the pieces are 2″-by-10″ pine, chemically treated to resist weather and insects.





3. Strips Smooth Corrugated Edges. Corrugated plastic sheeting used for shower stalls, walls and terrace roofs can be sealed tight with two plastic edging strips. One fits tightly into the corrugated ends, the other gives a close joint at the sides.



4. Rubber Tips Fit Tubular Legs. These rubber ferrules, resembling miniature crutch tips, slip onto metal legs of lamps, trays and racks to prevent marring surfaces on which they rest. They are made in ⅛″, ¼″, ⅜″ and ½″ sizes and come in sets of four.

Further information on the products described on this page can be obtained from: 1. Accurate Kitchen Cabinets Co., 2040 24th Ave., Brooklyn 14, N.Y.; 2. Dietks Forests, Inc., 1006 Grand Ave., Kansas City, Mo.; 3. Hanzen Plastics Co., 515 S. Good-Latimer Expressway, Dallas, Texas; 4. Schacht Rubber Mfg. Co., Huntington, Ind.

6 Home and Shop Uses for

Contact Cement

1 CONCEALING PLYWOOD EDGES is sometimes a problem. But not when you apply contact cement to the edges and wood strips. Let the cement dry for 30 minutes, stick on the strips, and tap them down with a mallet. The edges of the desk pictured below were finished off that way.

WHEN contact cement is applied to two meeting surfaces and allowed to dry, the parts take on a magnetic affinity for each other. Once they touch, they are really stuck.

This is the stuff that's now so widely used for bonding plastic and other coverings to kitchen counters and table tops, and for applying paneling to walls. It has many other uses, too, around a home or shop.

Don't toss out all other glues, though. You'll still need them for joints that must stand up under strain or heavy loads.

Once contact cement is applied and allowed to dry for 30 minutes, the pieces must be brought together accurately. A shaky hand or careless assembly may produce an offset joint that can't be shifted into proper alignment; the stuff grabs immediately.

If you should slip, however, and come up with a misaligned joint, contact-cement solvent or lacquer thinner will loosen the grip. Use the solvent for cleaning your brushes and for wiping up any cement drippings, too.

2 WHEN THIS PIANO KEY came off its base, contact cement put it back. Taping down the white keys kept them out of the way while the work was being done.

3 IT WILL HOLD GLASS, metal, rubber and plastic, as well as wood. Here a mirror is being bonded to the underside of the lid of a dresser-vanity. A wood strip was clamped to the lid to guide the mirror into proper place. Use one coat of cement on smooth surfaces, two (a half-hour apart) on porous materials.

4 WEATHERSTRIPPING sometimes loosens from a car door. Sand paint off first. Contact cement applied generously to metal and rubber will keep stripping on.

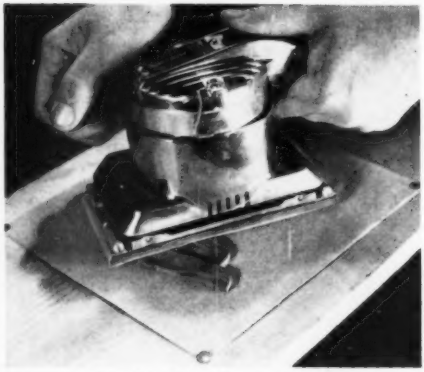
5 SANDPAPER sticks tight to a sanding disk with contact cement. When worn out, wet it with lacquer thinner to make the cement release its grip so that a new piece of sandpaper can be stuck on.

6 FRAME YOUR PICTURES this way. Cut the miters, check the fit, apply two coats of contact cement and let the pieces dry for 30 minutes. Press the corners together; they'll hold without slipping while you drive in nails to complete the job.

Nail Holder for One-Hand Use

If you have to work in a tight spot, such as under the eaves, where "one hand is for the job and the other for yourself," it's easy to start a nail held against the side of the hammer. Reaching for a second nail is the problem.

Try inserting nails in corrugated cardboard cut to fit the pencil pocket of your apron. You'll have a half dozen within easy reach.—*Roy L. Clough Jr., Bristol, N. H.*



Small Parts Held for Sanding

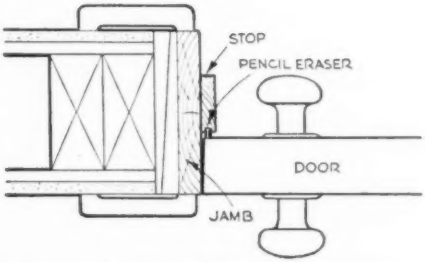
An extra sheet of sandpaper tacked to a board provides an anchor when you are sanding small parts. It will also hold long, thin strips more securely during sanding.—*Herbert K. Dowdy, Haskell, Okla.*

Cement Tube Hangs by Stopper

A finishing nail put over a workbench makes a handy hanger for a cement tube suspended by its screw-eye stopper. You won't be likely to puncture it with sharp tools, nor will you forget to seal it after use.

Coin Guard Protects Ruler

When cutting cardboard or heavy paper, a razor blade guided by a ruler not having a metal edge may cut into the wood. You can protect the ruler by holding a coin or a washer between it and the blade.—*Frank A. Javor, North Bergen, N. J.*



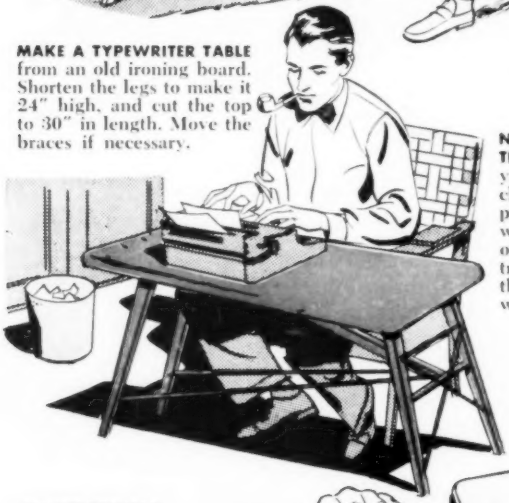
Eraser Stops Rattle in Door

A bumper made from the eraser on the end of a pencil will halt rattle caused by play in a door latch. Drill the doorstop slightly smaller than the diameter of the eraser and force it in. Trim the projection to about 1/16". It is most effective if you insert the bumper near the lock.—*E. Harvey Morrill, San Rafael, Calif.*

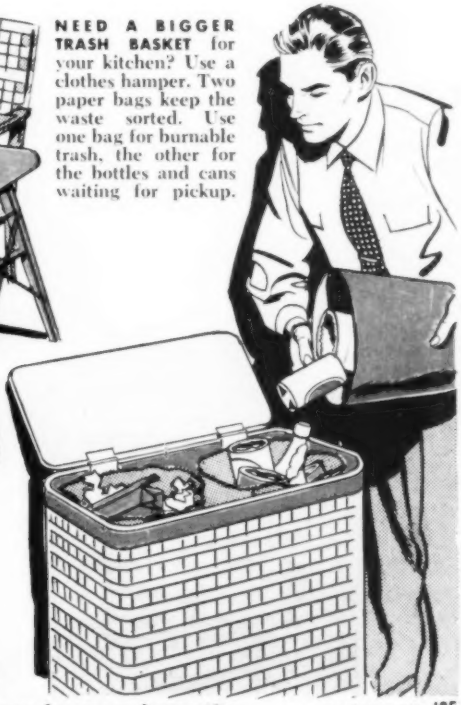
KEEPING THE Home SHIPSHAPE

A PIECE OF MODERN FURNITURE can be made from a cedar chest. Cut off the base so that the chest will rest flat on a bench mounted on modern style legs. Paint the chest black, the bench a light color.

MAKE A TYPEWRITER TABLE from an old ironing board. Shorten the legs to make it 24" high, and cut the top to 30" in length. Move the braces if necessary.



NEED A BIGGER TRASH BASKET for your kitchen? Use a clothes hamper. Two paper bags keep the waste sorted. Use one bag for burnable trash, the other for the bottles and cans waiting for pickup.

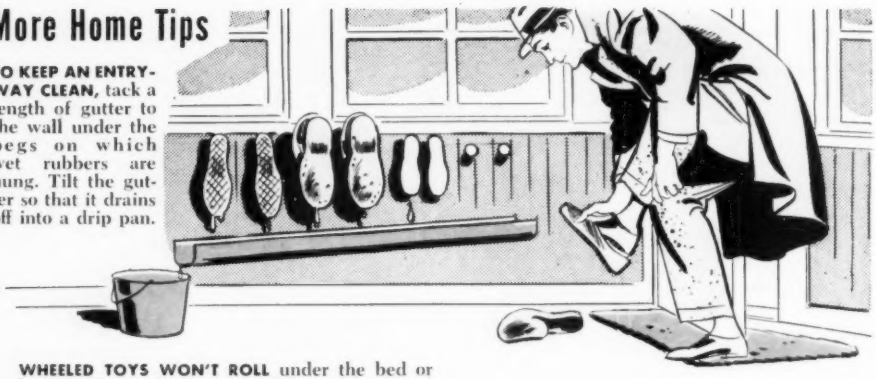


AN IMPROVISED FUNNEL for transferring liquids or dry substances can be made in a jiffy by rolling up a length of aluminum foil and shaping it to a cone. A double thickness of foil will make the funnel considerably stronger.

Please turn the page for more home tips

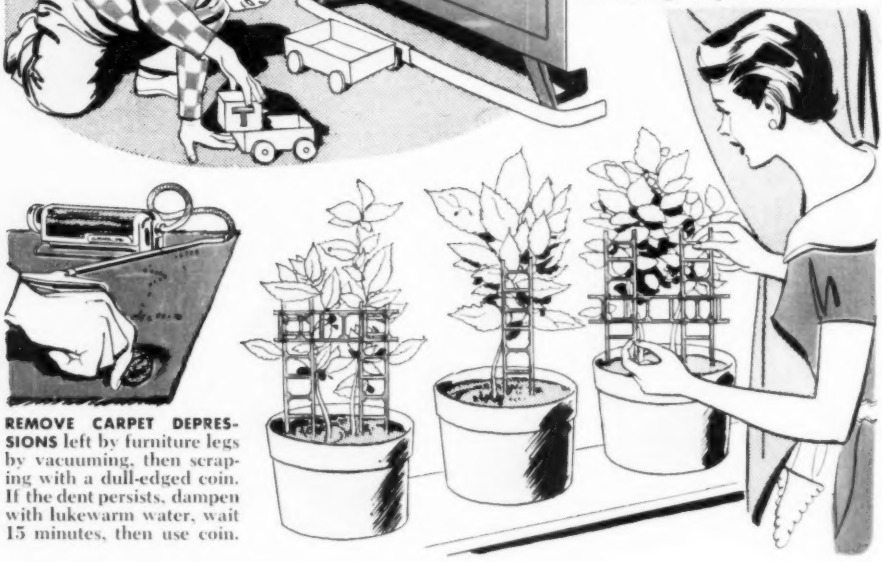
More Home Tips

TO KEEP AN ENTRY-WAY CLEAN, tack a length of gutter to the wall under the pegs on which wet rubbers are hung. Tilt the gutter so that it drains off into a drip pan.

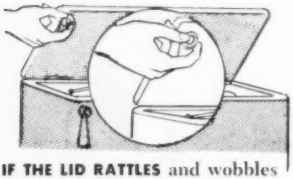


WHEELED TOYS WON'T ROLL under the bed or bureau if you fit curtain-rod bumpers around the legs. They're handy retrieving rods, too.

HOUSE-PLANT lattices can be made from the plastic trays that tomatoes come packed in. Cut off the sides, and the bottoms form tiny ladders. Snapping off a crosspiece on a ladder end makes legs to push into soil.

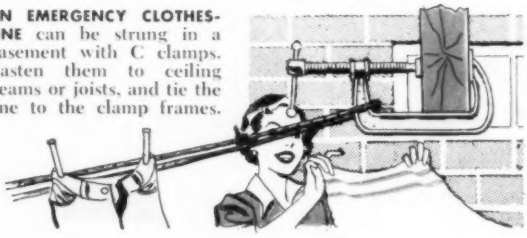


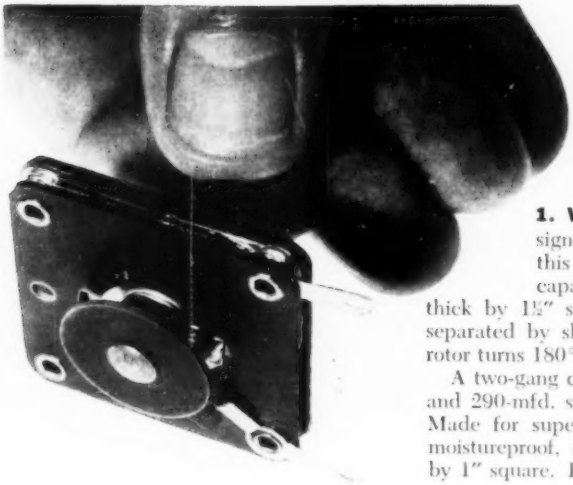
REMOVE CARPET DEPRESSIONS left by furniture legs by vacuuming, then scraping with a dull-edged coin. If the dent persists, dampen with lukewarm water, wait 15 minutes, then use coin.



IF THE LID RATTLES and wobbles on a tank fixture, even it up by cementing a rubber washer or a felt corn protector to the underside of the high corner.

AN EMERGENCY CLOTHES-LINE can be strung in a basement with C clamps. Fasten them to ceiling beams or joists, and tie the line to the clamp frames.



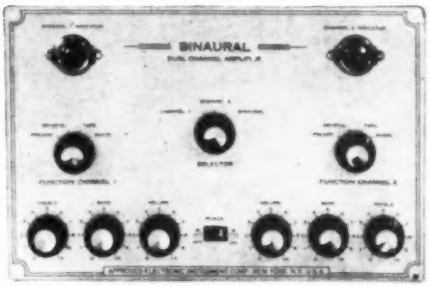


New
in Electronics

1. Wafer Tuning Condenser. Designed for miniaturized equipment, this condenser packs a full 365-mfd. capacity into a tiny sandwich $\frac{3}{16}''$ thick by $1\frac{1}{2}''$ square. It has metal-foil plates separated by sheets of plastic dielectric. The rotor turns 180°.

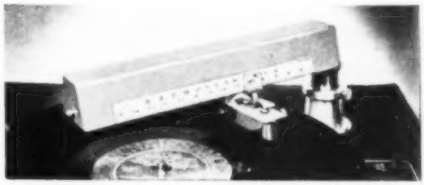
A two-gang condenser (not shown) has 120- and 290-mfd. sections and 15-mmfd. padders. Made for superhet circuits, it is sealed in a moistureproof, dustproof plastic case $\frac{3}{8}''$ thick by 1″ square. It weighs only a half ounce.

2. FM Tuner Kit. Designed for easy construction even by beginners, this kit comes with the front-end tuning unit, IF and ratio transformers prealigned. It features automatic gain control, a temperature-compensated oscillator, a built-in power supply, and a stage of audio amplification providing both low and high-level outputs. Sensitivity is comparable to that of the best ready-made tuners. The satin-gold cabinet (below) is styled to match the preamplifier that is offered by the same maker. With all the parts, tubes and a simplified instruction manual, the tuner kit is priced at $24.50.



3. Twin-Channel Amplifier. Two 4-watt amplifiers on the 9″-by-13″ chassis above handle entirely separate inputs and speaker systems. Designed for binaural reproduction, the unit has dual volume, bass and treble controls, and separate cathode-ray output-level indicators. Both channels have inputs for radio, tape, crystal and reluctance cartridges. The complete amplifier kit with instructions is priced at about $40.

4. Radial Tone Arm. Traversing records on a true radius, the stylus of this tone arm is free of the tracking error inherent in swinging arms. The cartridge rides on ball bearings and a stainless-steel track. Its stylus is lowered by tilting the arm, and if lifted can be replaced to resume play at exactly the same spot. Records can be indexed by a scale for accurate cuing. The tone arm, which takes almost all of the popular cartridges, is priced at about $44.



Further information on these products can be obtained from: 1. Lafayette Radio, 100 6th Ave., NYC 13; 2. Heath Co., Benton Harbor, Mich.; 3. Approved Electronic Instrument Corp., 51 Vesey St., NYC 7; 4. Bard Record Co., Inc., 66 Mechanic St., New Rochelle, N.Y.

What's a Vacuum, Pop?

Little Magdeburg hemispheres made from hardware-store parts will help you give the answer.

By Andrew Pfeiffer

SUPPOSE you were asked to define a vacuum. Could you do better than this:

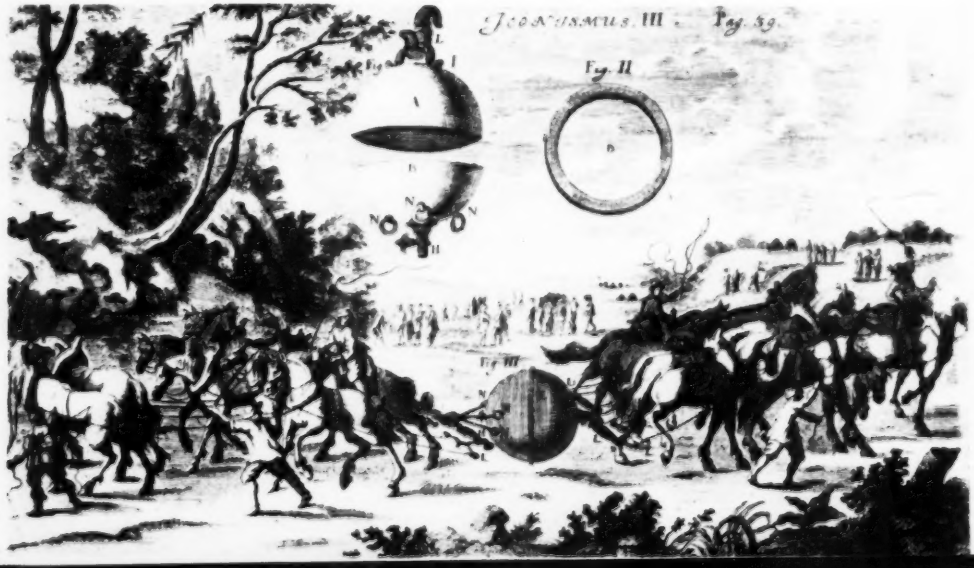
"A vacuum? Well, uh, it's uh . . . it's nothing at all. It's what's left when air is pumped out."

The average inquisitive youngster won't let you off that easily.

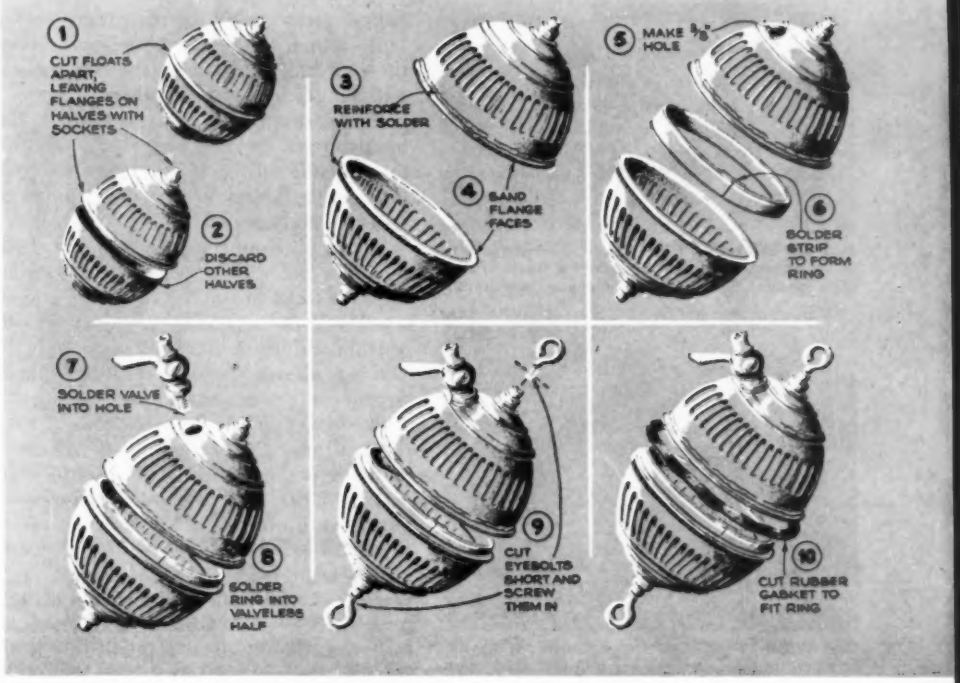
"But, Pop," he will probably say, "if a vacuum is *nothing*, how can it do *something*? What makes vacuum drive our windshield wipers like you once said? And when Mom opens a can marked vacuum-packed, something hisses. If nothing comes out, then why does it hiss?"

Now that really backs you into a corner. But you needn't stay there. You can come back and look the youngster in the eye once more.

SWINGING ON NOTHING but two hollow, unconnected hemispheres, the boy at left is held up by air pressure. These homemade Magdeburg hemispheres get muscles when the air is pumped out of them, creating a vacuum. The engraving below, familiar to students of old physics texts, shows 16 horses tugging at the original Magdeburg hemispheres, made about 1650 to show what an air pump could do.



Making Magdeburg hemispheres from copper tank floats



I got the idea of how to do it from a recent book, "The Construction of Laboratory Apparatus." This is issued by the United Nations Educational and Scientific Council to foster science in undeveloped lands.

A 300-year-old demonstration. You visit the hardware store and buy a couple of toilet-tank floats, a small petcock and two ¼"-20 eyebolts. With these items and an old inner tube you can make a miniature version of the famous Magdeburg hemispheres, built about 1630 by Otto von Guericke to demonstrate the air pump he had invented.

You lead up to an explanation of the hemispheres by imparting a few interesting facts to the youngster.

"A vacuum," you can say, "exists only in an enclosed space from which air is excluded. When the coffee can is punctured, you hear the air outside rushing in to fill the vacuum."

This obviously leads to another question. Here's your answer:

"Why? Because we live at the bottom of an ocean of air. All that air above us has weight. A column of it only one inch square weighs 15 pounds. If we could weigh that coffee can on a very sensitive scale, we'd find it heavier after the air got in."

"But, Pop—if all that air over us is so heavy, why doesn't it flatten us?"

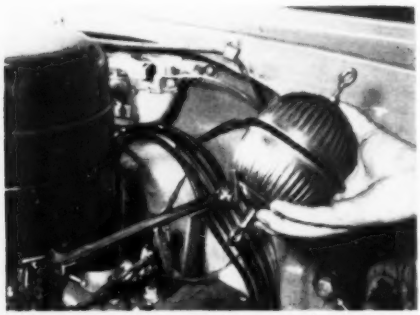
"Because the pressure inside our bodies is the same as it is outside. Luckily, a gas doesn't just push its weight straight down like a rock; it is fluid, and pushes every which way—up, down and even from inside out."

Tin can proves it. Here you can toss in a spectacular little stunt with an empty syrup can, to show just what happens if the inside pressure *isn't* the same as that outside. Pour a quarter of a cupful of water into the can and put it on the stove *with the cap off*.

When steam is spouting from it, find yourself a couple of pot holders and get your quiz kid to watch.

"The steam has driven all the air out, right?" You yank the can off the flame

FOR AN AIRTIGHT FIT, smooth the flange surfaces against which the gasket is seated. Rub both shells, flange down, on fine sandpaper.



SLIP WIPER TUBE onto the petcock. With the engine running, hold shells together and open petcock. Keep fingers away from the joint. Close the valve, and shells will stay joined.

and quick as a wink slap the cap on it tightly. "Now I'm going to hold the closed can under running cold water, which will cool the steam, turn it back into water, and leave—"

"A vacuum!" shouts your offspring.

"And with a vacuum inside and 15 pounds of air per square inch on the outside, watch what happens . . ."

You douse the can under water, and there is a crunch as it folds up, squashed almost flat. (Keep your fingers well away during the stunt; the wild cry of a father in pain rarely impresses the young.)

This should keep the child quiet long enough for you to build an even more impressive demonstration—your own working model of von Guericke's famous Magdeburg hemispheres. Here's where you use that hardware you bought.

Use half of each. With a sharp knife, cut both floats apart on one side of the joining flange (the metal is only .010″ thick). Be sure you cut on the side of the flange away from the threaded socket (into which the float rod screws). Keep the two half shells with the rod sockets and flanges; discard the others.

Since they are thin, reinforce the hemispheres by running solder around the outside of each flange. Then rub both shells, flange down, on sandpaper to remove the burrs left by the knife.

About 1″ from the socket of one shell, punch a hole. Enlarge it with a round file to a tight fit for the threaded end of a petcock. Solder this in place from both outside and inside the shell.

Ring aligns shells. From thin sheet copper or tin-can stock, cut a strip ⅜″ wide. Overlap the ends to make a ring that will fit inside the flange of one shell, and solder the joint. Then solder the ring into the shell without the petcock, letting it protrude ¼″ so that the other shell will fit over it.

Cut both eyebolts to ¾″ length and screw one into each socket. From an old inner tube, cut a ¼″-wide gasket to fit the ring. Rub petroleum jelly on both sides of the gasket, put it over the ring, and put the two shells together.

Use engine vacuum. Now catch your child's attention and start your car engine. Disconnect the rubber tube from the windshield wiper. After showing your young skeptic that the copper sphere consists of two easily separable halves, attach the vacuum line to the air cock.

Open the cock for a few seconds, holding the shells firmly together. Then shut the petcock and detach the tubing. Tie a piece of clothesline to each eyebolt.

At Magdeburg in 1650 they used 16 horses to pull the sphere apart. You'll probably have to settle for a family tug of war. If during this struggle somebody opens the petcock suddenly, you'll all sit down at once.

Best of all, hang the sphere securely from a joist, doorway or swing and let your youngster chin himself on it. This should keep him out of your hair until he thinks up some new questions.

NEXT MONTH: Learn how to make simple lab equipment that will break up ordinary water into its component gases.

How to Re-Use Paint Thinner

THINNER used in cleaning paintbrushes can be re-used if you pour the several washes together after each use. Suspended matter settles on the bottom overnight. The next time you need it, just pour off the clean thinner from the top of the can.

Soft-Metal Filing Made Easier

FILING solder and other soft metals is speeded if you can do it in a basin of warm water containing a detergent. The wetting agent keeps the teeth from filling up with the metal.

Sharpened Pipe Cuts Disks

A PIECE of pipe or tubing sharpened on one end can be used to cut small disks from felt, rubber or plastic. Hammer the pipe into the material and punch out the disks, which make good spacers, washers, nonskid jewel-box feet or even model wheels.—*Frank A. Javor, North Bergen, N.J.*

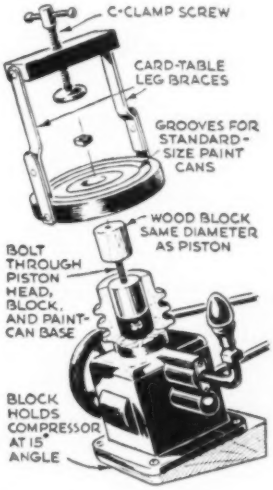
Old Air Compressor Mixes Paint

HALF an hour on this homemade paint shaker will put that old can of enamel or lacquer back in shape for any brushing or spraying job. For the agitator use a junked air compressor.

Remove the piston and bore a ¼″ hole through its head. Turn a wood plunger the same diameter as the piston and long enough so its top surface is above the open head of the cylinder when the lower end is in contact with the piston at the bottom of the stroke.

Drill a ¼″ hole through the center of the plunger and connect it to the piston head with a bolt which extends on through a paint-can platform above it.

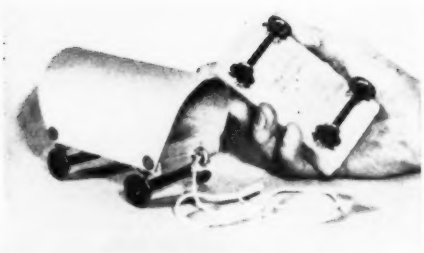
This platform is turned from ¾″ stock and



should have a series of concentric grooves cut in its top surface to take standard paint-can sizes.

Ream out the upper end of the hole in the platform so the nut which holds the assembly together can be countersunk. Attach card-table leg braces to opposite sides of the platform and bridge their upper ends with a piece of ¾″-square hardwood. At the center of this bridge bore and tap a hole for a C-clamp screw.

Incline the compressor at a 15° angle by inserting a wood wedge between it and the worktable. To run the compressor at the right speed use a 3″ pulley on the motor and an 8″ pulley on the crankshaft.—*B. F. Pace, Carrollton, Ga.*

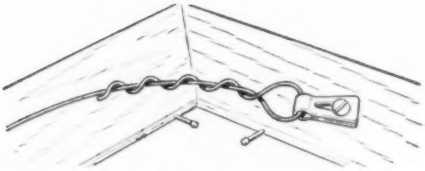


Toy Rolls on Film-Spool Wheels

You can make a covered-wagon pull-toy for a child with a couple of old film spools. Screw a cup hook into each corner of a block of wood and clinch them over the spool spindles. Then tack a curved piece of cardboard over the block. Fasten a screw eye in one end for the pull-cord.

Good Print Guides Developing

A GUIDE print kept near a photo-developing tray in a pan of water will tell you when to drop a new print into the stop bath. Judging full development by a safelight is tricky, especially for a beginner.



Wire Linked to Picture Frame

Two links from a sash chain will hold picture wire securely to the back of a frame. Attach with wood screws, as in the drawing, loop the wire through, and twist the ends.

Bird's Play Pen Is Lamp Shade

AN OLD lamp-shade frame enclosed with ½" hardware cloth and slipped over the bottom of your parakeet's cage makes a fine play pen for him. Solder on the mesh. Remove the cage bottom before securing the shade frame with pull springs. A dowel makes a perch.

How PSM readers voted on Pay TV

PAY to watch TV? No! Thousands of times no! That's the vote of PSM readers who mailed in the ballot on toll TV from the October issue (p. 145). More than 90 percent voted against it. About six percent were for it, and fewer than three percent were undecided but willing to give it a trial.

Many readers felt so strongly that they extended the poll and got the reactions of friends and fellow workers. One man submitted a survey of 125 people, and quite a few ballots had attached petitions bearing 20 to 30 signatures.

A remarkably large number of readers were incensed at the prospect of being offered TV programs that they could see only after paying a fee. Letters—often long ones—amplified their opposition.

The principal objection was frankly economic. "We feel we paid enough for TV when we bought it," wrote an Indianapolis reader and his wife. A Connecticut man said, "If I have to pay to watch my TV set, out it goes." A Maryland physician summed up a recurring concern: "Think of the thousands of poor people whose only entertainment is TV. They could not afford toll TV."

Many readers questioned the practicality of toll TV in fringe areas with erratic reception. Would they lose their admission price if the picture faded out in the middle of an expensive show?

Only a few readers indicated their preference for one of the proposed toll schemes. (These were described on pp. 142-3, October.) The vote was fairly evenly divided, with Zenith's Phonevision gaining a slight advantage.

You Can Tune in Better TV Pictures

Getting a perfect image? Chances are that you're not. Here an expert tells you how to use those little gizmos on your set.

By John K. Frieborn

CONSIDERING how long television has been around, it's surprising that people aren't getting better pictures. The chances are that what you *think* is a good picture is not really as good as it could be. You may not be using all the controls. Or you may be using them improperly.

There are five basic adjustments that you should know and use. Two—focus and vertical hold—require only occasional setting. The three others—brightness, contrast, fine tuning—are needed each time that you tune in a picture. You

can learn to use them quickly. And once you do, you'll be amazed at the results.

What makes the difference? I found out during a bull session that we had the other night. My neighbor Bob was beaming proudly at his brand-new 21-incher. Jim—he's chief engineer at our town's TV station—was betting Bob a piece of his wife's apple pie that he could tune in a clearer and better-looking picture.

"Okay," said Bob, "but how?"

The "portrait" look. Jim nodded toward Bob's screen. "You watch for little clues that tell you whether the picture is good or bad. Now I love Lucy, too, but not with that pasty face and those

5 Steps to Sparkling Pictures

1 **BEGIN** by turning the brightness and contrast all the way down.

2 **TURN THE BRIGHTNESS UP** until you get a faint image on the screen, with the highest highlights just beginning to appear.

3 **TURN THE CONTRAST UP** until you get what you think is a good picture, one that has a wide range of gray tones as well as the blacks and whites.

4 **IF DETAILS ARE WASHED OUT** in both the light and dark parts of the picture, decrease the contrast.

5 **IF WHAT SHOULD BE LIGHT GRAYS** appear white, decrease the brightness. If the dark grays appear black, increase the brightness.

black holes for a mouth and eyes. You have to get the eyes clear and sparkling, with delicate modeling in the face and shining highlights on the hair."

I've fooled around with photography a bit, so that I knew what Jim meant. "Something like the difference between a fine portrait and those grim, flash-lighted news shots that you see in the papers?"

"Right," said Jim.

Bob gave Jim a challenging look. "Okay, you're on, and I'll even raise the ante. *Two* pieces of pie. Where do we start operations?"

"Adjust the focus first," said Jim. "This must be correctly set before you can judge the effect of other controls."

Adjusting the spot. We pulled out the set, and Bob found the focus knob in back. I began to rig up a mirror so that Bob could see, while Jim explained that it was like focusing a camera, except that in this case you were changing the size of the moving spot of light that traces the picture. If the spot is too big, it covers up the differences in brightness that form the light and dark parts of the picture. This blurs the fine details and gives you a fuzzy image.

"I can't make head or tail out of the picture when I'm up this close," complained Bob.

"That's part of the trick," said Jim. "Don't look at the image at all, just at the horizontal scanning lines. Pick a uniform gray area near the center of the screen. Then adjust the focus so that the white lines on the screen are as thin as you can get them."

The vertical hold. Bob looked puzzled. "I've got the white lines thin, but they seem to run in pairs—two close together, then a wide dark space, then another two. What's that?"

"Right there you have a clue," said Jim. "In fact, it's called pairing, just as you say. In its worst form, the lines actually meet and overlap, giving the effect of having only half the normal number of lines. The fewer the lines, the fewer the details you get in your picture. This is sometimes improved by adjusting the vertical-hold control."

Bob looked surprised. "The vertical hold? I always thought you just used that to keep the picture from rolling."

"You do," said Jim, "but it has a more important function that most people don't know about. Now start turning the knob slowly to the left."

"The picture rolls."

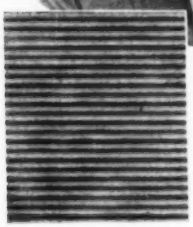
"Okay, stop. Now turn it slowly to the right."

"It rolls again."

"Okay, stop there. Now turn the knob

Scanning lines give you a quick clue to good focusing

IN FOCUS



SCANNING LINES at left are clear and sharp, produce a good image above. Turn the focus knob until the lines are as thin as you can get them. Watch central area of the screen.

OUT OF FOCUS

FUZZY LINES at right obscure delicate details, produce a picture that looks like an out-of-focus photo. If the lines are still blurred after refocusing, check the picture for "pairing."

about halfway between those two positions and watch the scanning lines."

"Why, the lines look pretty evenly spaced now," exclaimed Bob. "Thin with wide, dark spaces in between."

"Right," said Jim. "Just remember that the best spacing should come at a setting about midway between the two points where the picture starts to roll."

Bob looked bewildered. "But the program would be half over by the time that you did all this."

"No," replied Jim. "Don't forget that the focus and hold controls need only periodic checking. Now let's take a look at the everyday controls."

Brightness and contrast, as Jim explained, must be adjusted together because each affects the other. The brightness control establishes the average brightness for the scene, and the contrast control adjusts the range between maximum and minimum brightness. If parts of the scene that should be light gray look as white as the white parts, you have what is called "white compression."

Bob broke in: "White what?"

"White compression," Jim repeated. "This is just jawbreaker jargon meaning that Lucy's face looks as blank and flat as an uncooked pancake. Since it's all white, you don't pick up any fine details in the facial contours or expression, no soft shadows, no brilliant highlights."

"You mean," Bob said, "that we know people don't really look that way, so we know that we must be getting a bad picture?"

"Right! That's another one of those clues we talked about. In the same way, if you can't see any wrinkles in Gobel's pants, you have 'black compression.' The gray tones that would normally show up as creases and folds are as dark as the black parts, so that they all blend together in one black blur."

Steps in tuning. I glanced at Jim. "You said that the controls affect each other. Which one do you begin with?"

"Turn both the brightness and contrast all the way down. Here, watch."

"The screen goes blank—no picture at all," said Bob.

"You start with nothing," nodded Jim, "and build up your picture until it's perfect. That way, you're sure of getting better results than just trying to correct an already bad picture. Now turn up the brightness slowly."

Bob was peering closely at the screen

You can balance your picture like a well-exposed photo

WELL-BALANCED PICTURE

WHITE COMPRESSION

WHITE AND BLACK COMPRESSION

BLACK COMPRESSION

ALL OF THESE PICTURES ARE WATCHABLE, but only one is a real pleasure. Note how white compression (absence of light-gray tones) washes out details in actor Dane Clark's face, making image look like an overexposed photo. In black compression (absence of dark-gray tones), clothing and background become indistinguishable, look underexposed. Both black and white compression produce harsh contrast between pasty whites and dense dark areas. Careful balance of brightness and contrast gives the good picture above, showing full facial expression, highlights, texture and small details.

now. "I can just see a very faint image."

"Good. Stop as soon as the highest highlights just begin to appear—like the highlights on that fellow's hair. See what I mean?"

"I don't see how you'll ever get a picture out of that," Bob put in. "No contrast at all."

"That's what you're going to add right now," Jim explained. "Turn up the contrast slowly until you get what you think is a good picture, one that has a wide range of gray tones as well as the blacks and whites."

"Looks pretty good," said Bob.

"Good, but could be better still. Here's another one of those clues. See how some of the details are washed out in both the light and dark areas? Now back off the contrast a bit."

"That brings out the details in the dark areas better," said Bob, "but now the light grays look too white."

Jim smiled. "You can correct that by decreasing the brightness slightly. If the reverse happens and the dark grays look too black, increase the brightness."

A matter of choice. "One thing bothers me," said Bob. "You said something about turning up the contrast until you get a picture that you *think* looks good. Can different people like different pictures?"

"The exact amount of contrast," said Jim, "depends partly on room lighting—you need more if the lights are bright—and partly on personal taste."

He turned to me. "You're the photographer. What do you say?"

I explained that Jim meant that some people like a "flat" picture, which shows details well but with less difference in brightness between tones. Others prefer a "contrasty" picture, which has sharp distinctions between light and dark

[*Continued on page 244*]

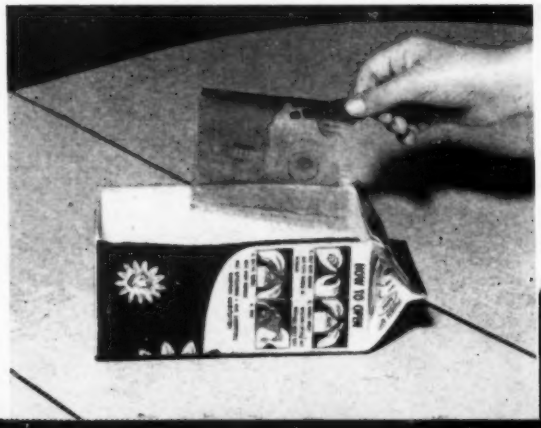
Five Darkroom Tips

1 TEST A FIXING BATH with a strip of exposed, undeveloped film. Twice the time that it requires to clear is a safe fixing period. If the clearing takes over five minutes, it's better to throw the solution away.

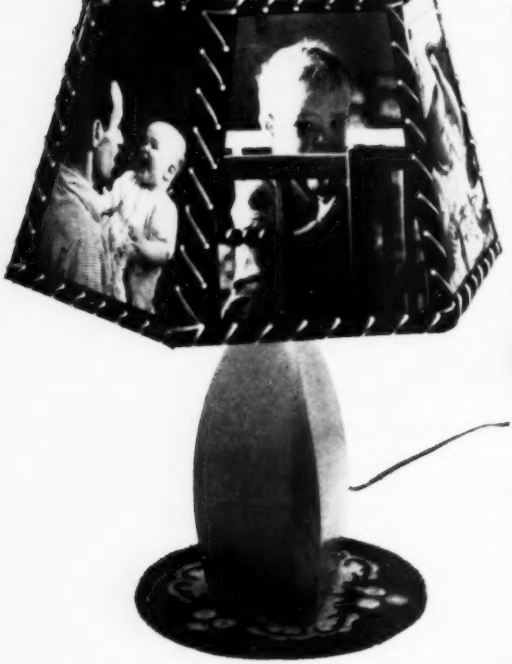
2 A ROLL OF 620 FILM can be used in a 120 camera if you can't buy the 120. Use a taper reamer to enlarge the spool holes.

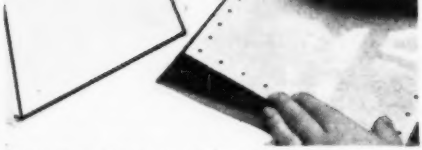
3 WANT PRINTS WITHOUT WHITE BORDERS? Make them by pressing strips of two-faced adhesive tape into an enlarging-paper box, pressing a sheet of paper (back down) on the tape.

4 HALF-GALLON MILK CONTAINERS, now used in many parts of the country, make emergency developing trays for cut film up to 4" by 5" in size if you cut away one side.



5 WALL STAINS in a kitchen or bathroom darkroom can be avoided by putting up a temporary splash shield made of oil cloth or plastic sheeting. Tape the shield to the wall.





STRIP THE OLD PANELS from their frame by cutting the lacing. Lay one on your print as a template and mark along the edges. You can usually see through the template to center it.

BIND THE EDGES of the print after it has been cut to size. Plastic-coated tape ¾" to 1½" wide works well. It frames the picture and reinforces the holes that are punched later.

PUNCH HOLES FOR LACING with a ⅛" paper punch. The more common ¼" punch makes too big a perforation. Mark hole positions first by laying template over print a second time.

FASTEN PHOTO PANELS to the frame with plastic lacing sold in hobby shops. Or lace them on with rug wool, heavy cord, or yarn in a color to match the furnishings of the room.

How to Make a Photo Lamp Shade

WHY hide those family pictures in an album? You can display them handsomely on a lamp shade.

Salvage a frame from an old shade or buy a new one at the dime store. It should have flat sides to simplify mounting. The easiest picture panels to make are 8-by-10 enlargements on double-weight paper. You can create a more striking effect, however, by printing on a translucent paper with an emulsion on both sides, like Kodak Translite. When these photos are lighted from the inside, they glow with a brilliant three-dimensional effect.

For something very special in a photo lamp shade, color the reverse side of the translucent prints with transparent photo oils. Then black-and-white images take on full color as you light the lamp.

URANIUM HUNTERS test a sample of ore with a multitube instrument. Rugged and sensitive, this is newest of the four major types of counters. (Photo by Fred Baker of the Denver *Post*)

How to Choose a Geiger Counter

Rate meter? Multitube counter? Scintillation counter? Here an expert advises you on how to buy a uranium-finding instrument.

By Griff Borgeson

HUNTING uranium with a Geiger counter is like stalking game with a well-trained hound. All of the hundred-odd kinds of uranium ore are radioactive, and hardly any other rocks are. So a counter's ability to "see" radiation can lead straight to pay dirt.

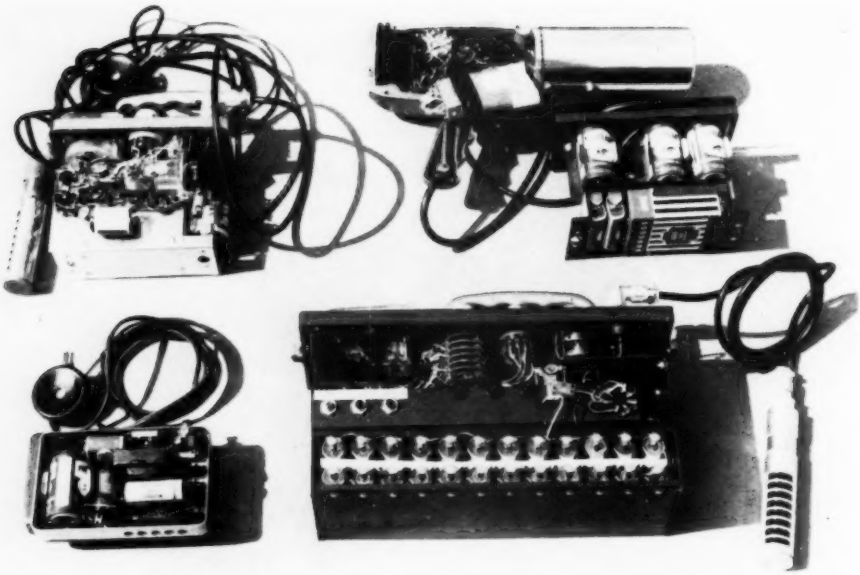
Counters are the great equalizers of the uranium rush. They give a tenderfoot an even break with trained mining men, and account for rank amateurs' successes in history's greatest metal hunt.

You can pay from about $20 to $2,000 for a counter, and choose from dozens of models. Which will best suit your needs?

What counters do. Counters differ in performance and price much as cameras do. Both are receivers of radiation.

A counter's "lens" consists of one or more Geiger tubes, or a scintillation crystal. Like a big-lensed camera, a counter with a large receptive element

can receive a great amount of radiation at any moment the *average* counting



WHAT YOU PAY FOR is shown by inside views of simple Geiger counter (lower left); rate-meter Geiger counter (upper left); gun-type scintillation counter (upper right); and 25-tube Nucliometer (lower right). Increased sensitivity demands more complicated, costlier circuits.

Shopper's checklist compares counters' fittings and controls

Here's what important features do, and how they vary. Photo at right shows equipment of a single-tube rate-meter Geiger counter.

Indicating Devices

HEADPHONES and NEON COUNT INDICATOR *detect* radioactivity. Click in phones, flash of lamp, register a "count"; to *measure* radioactivity, you tally counts per minute. These are simplest counters' only indicators. On counter at right, they supplement a meter. More sensitive counters omit them, as the counts would come too fast to tally.

RATE METER *detects* and directly *measures* radioactivity, giving averaged—and so, highly accurate—counting-rate reading.

Controls

SENSITIVITY SWITCH adapts scale of meter readings to strength of radiation. If "hot" area sends needle off scale, you change to less-sensitive range. Inexpensive rate-meter counters have two or three ranges; scintillators and multitube types, up to five.

TIME-CONSTANT SWITCH, with two settings (photo) or more, gives quick registering for fast, rough-and-dirty prospecting; slower response, for careful measurement.

ON-OFF SWITCH may be combined with sensitivity switch, as in this model.

CALIBRATING KNOB compensates for voltage drop of used batteries, on instruments from rate-meter Geiger counters up.

Probe

DETACHABLE PROBE, found on some models, is a desirable feature. You can tie it to a stick, take ground readings while walking upright. Lightweight probe is handier than whole counter for checking ore specimens.

can receive a great amount of radiation in a short time. In a camera, this permits good pictures in weak light; in a counter, it enables you to detect weak or distant radiation. And it makes both camera and counter expensive.

If a camera hasn't a big lens, you can make it receive more radiation by leaving the shutter open longer. For the same effect, you can increase a counter's time-constant. This is the duration of a single reading or "exposure." All but the cheapest counters have a control knob providing a long or short time-constant, and automatically make "exposures" of the preset length.

There are four major types of counters in general use now.

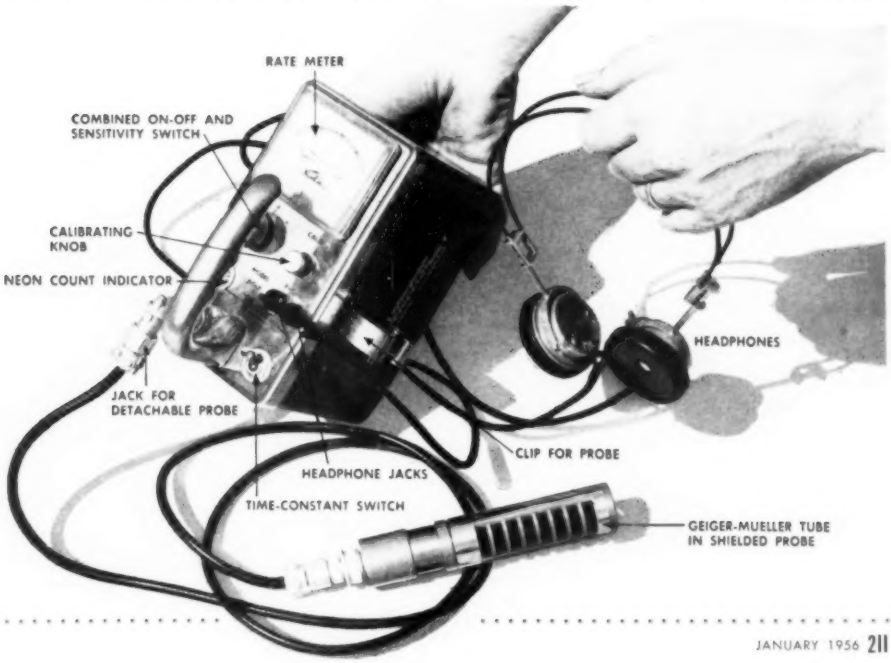
Simple Geiger counter. Cheapest of available types, this light-duty instrument uses hearing-aid batteries and announces radioactivity by audible clicks. Models are priced from about $20 to $50.

Rate-meter Geiger counter. This is the next step up. Besides registering endless clicks, it has a meter which shows at any moment the *average* counting rate, or strength of radiation. Rays come from uranium in irregular bursts, rather than an even flow; so an average count is a more accurate count, and the meter's averaging action gives it to you.

Rate-meter Geiger counters cost from about $70 to $350. Bigger tubes and costlier materials put these fine instruments in a class apart from their budget-priced cousins. A new development, the bismuth tube, greatly improves their efficiency and sensitivity.

Single-tube rate-meter counters are simple to maintain; you can install a new sensitive element anywhere, a great advantage if you're far out in the hills. Easy to use, they're excellent for exploration, making grid surveys, and assaying radioactive ore. Available accessories will adapt some to take readings of the walls of deep drillholes and wells.

Most important limitation is that, to detect faint radiation, you have to use long time-constants—too long for fast reconnaissance on foot, and impossibly



ADVANTAGES of rate-meter Geiger counter include compactness, light weight. Serious prospectors should settle for nothing less, and many a professional asks for nothing better.

NUMBERED LIGHTS in four columns show precise number of counts in selected interval, on Hoffman's unique scaler-type, single-tube Geiger counter. Rough surveying uses meter dial alone.

long for effective use in a car or plane.

Scintillation counter. Many times more efficient and sensitive than any single-tube Geiger counter, this instrument detects more rays, weaker rays and more distant rays. Hence it can use much shorter time-constants. Scintillators, as they are sometimes called, can be used for prospecting from the seat of a car. The most sensitive ones also can be used in airplanes.

The range of sensitivity depends largely on the size of the radiation-sensitive crystal. And since these artificially grown crystals are expensive, the crystal's size is reflected by the instrument's price tag. A counter with a 1"-by-1" crystal can be had for $200; a 2"-by-2" job costs $700.

Scintillation counters have three drawbacks. They are not as mechanically rugged as good Geiger counters. They often work less well in hot weather. And only expert technicians, using special equipment, can service their sensitive elements.

Multitube counter. Newest of major types, the rate-meter multitube Geiger counter achieves high sensitivity with from six to 60 Geiger tubes. It has the ruggedness of the single-tube Geiger counter; and the sensitivity and speedy operation, although not the compactness, of the scintillator.

Multitube-counter models with 24 or 25 tubes, costing about $600, are the most popular. These versatile tools can be used for all kinds of prospecting—shoe-leather, carborne and airborne.

Which type? How can you make the most sensible choice, among these four types, for your own particular needs? Here are some suggestions:

- For dabbling in uranium hunting, you might as well choose a simple Geiger counter *without* a rate meter. You'll find this low-priced instrument quite adequate for checking rocks around a farm—or for testing interesting formations, in passing, on occasional fishing trips. By placing the counter smack against every rock that looks promising, you can certainly tell whether or not it's hot. This means extra footsteps, but it also means that your investment is in proportion to the time you can devote to looking for A-ore. While serious prospectors do not willingly settle for tools in this price bracket, valuable uranium finds have been made with these elementary but effective instruments.
- A rate-meter Geiger counter is the right kind if you plan to hoof it back into the hills on a two-week vacation, or for more serious uranium hunting on foot. If there's hot ore to be found, a thorough search with one of these counters will find it. After you've made a strike and start shipping ore, you'll still need the trusty single-tube counter for pinpoint exploration of your property, for field assays and for grading ore shipments. Many

professional "shoeleather" prospectors use no other instrument, and wish for nothing better.

• If you're one of the lucky ones who can afford the very best, then a scintillator or a multitube counter is your dish. An investment of $500 to $600 will get you an instrument that is ideal for carborne work and can be used for some airborne prospecting. Really powerful and effective airborne models start at about $1,000. Of course, either a multitube or scintillation counter is excellent for use on the ground.

In short, buy the best instrument you can afford, that suits your needs; but don't hunt quail with a cannon.

Rent and try. Most dealers have instruments they rent by the day or week to occasional prospectors. If you've tentatively decided on the kind you need, but want to make sure that it's the right one, ask a dealer about renting one for the weekend. After a tryout, you'll be sure that you're getting what you want—or you can change your mind, without taking a loss.

Among counters of the same general type, details vary, and some pointers regarding them may be helpful:

About meter dials. The graduations on most rate-meter dials give readings in milliroentgens per hour, or mr/hr. Other dials indicate counts per minute or CPM. These are just two different ways of expressing the same thing—radiation intensity.

In almost all field work, it makes no difference which unit you use. A counter's dial can be graduated in "ax handles"; what's important is an increase in the reading.

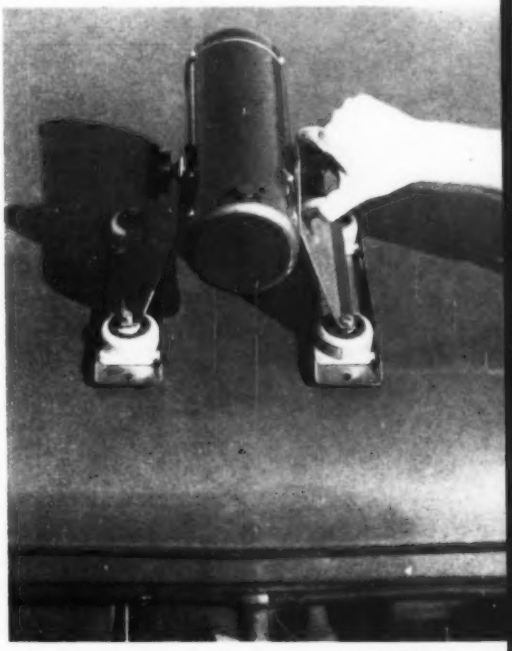
How sensitive? A practical measu of a counter's sensitivity is the smallest difference in radiation intensity that you can read *unmistakably* on its scale.

Because radiation from uranium is intermittent, every counter's meter needle wavers back and forth; this wavering is worst, and most confusing, with the shortest time-constant setting. But the needles of some instruments swing only

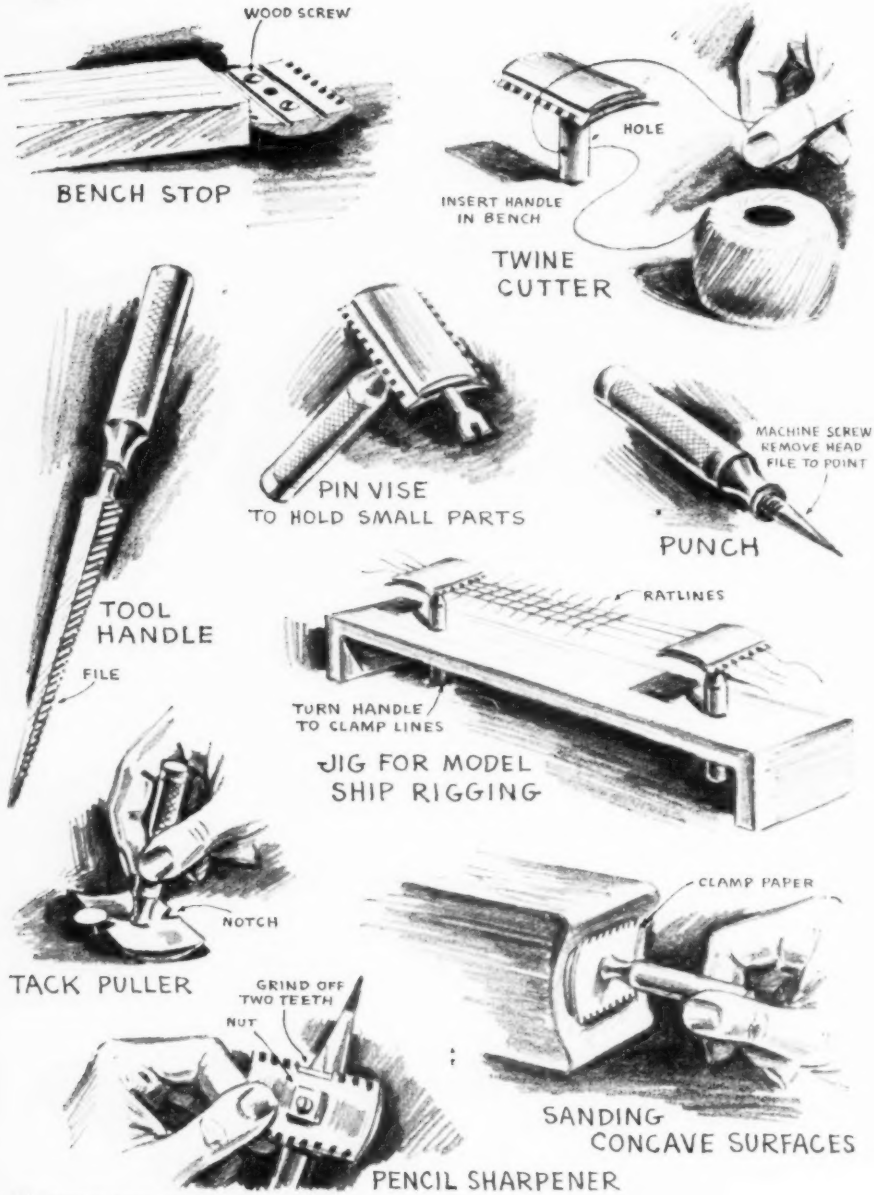
[*Continued on page 248*]

AIRBORNE PROSPECTING calls for a costly, highly sensitive counter like this scintillator with a 2"-by-2" crystal. The expense of flying makes a less effective instrument false economy.

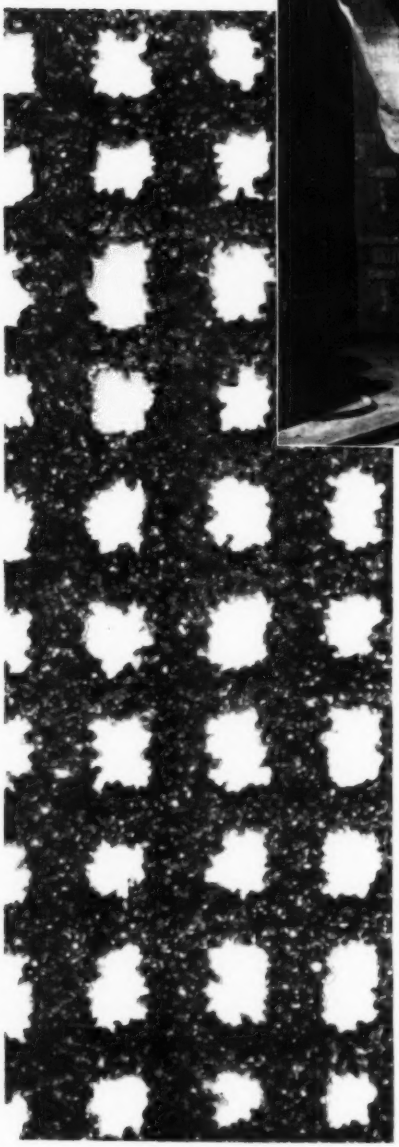
CARBORNE SCINTILLATION COUNTER "sees" farther when detecting unit is mounted on car top, as below. Rubber-sprung mounting adapts it to be used there, or on floor of a plane.



9 USES FOR Old Razors



MESH SANDPAPER that speeds finishing jobs is made from screenlike rayon. Photomicrograph below shows how tiny abrasive particles completely cover all sides of the weave.



New 'Sandpaper' Lasts Longer

Clogging dust escapes through the open mesh of this transparent abrasive cloth —to make finishing cheaper and easier.

By George H. Waltz Jr.

THAT man above is looking *through* a sheet of the newest thing in "sandpaper"—a tough, open-mesh abrasive cloth. Already established in industry, it is now available for home-shop use.

The new material consists of a sturdy, open-weave rayon fabric that is coated with abrasive grit on both sides and through its mesh. A tough waterproof resin bonds the abrasive to the fabric. Several abrasive manufacturers make it under different trade

In the shop, it smooths faster

names, among them Gritcloth, Sand Screen, Wetordry Fabricut, and Speedwet Screenbak.

The cloth's big advantage is its freedom from clogging. Whatever you sand off passes right through the window-screen-like openings. This greatly speeds up the sanding of painted surfaces and soft metals like do-it-yourself aluminum.

Waterproof and durable. The material has abrasive on both sides. When one side wears smooth, you just turn the sheet over. It is also waterproof. Not only can you use it for wet-sanding, but you can wash it clean after use by holding it under a faucet. You can expect one sheet to last longer than 10 or 15 sheets of ordinary sandpaper.

The stuff is available in standard forms —sheets, disks and rolls—for hand or power sanding, and is made in grades ranging from 100 to 400 or 600 grit. Coarser grades are being developed.

Works on anything. You can use the cloth for anything that you could use ordinary sandpaper for—and then some. It does a good job of shaping, smoothing and finishing most materials: wood, soft metal, plastics, glass and leather, as well as finished surfaces. It can also be used to remove paint. And it does most jobs in half the time normally required.

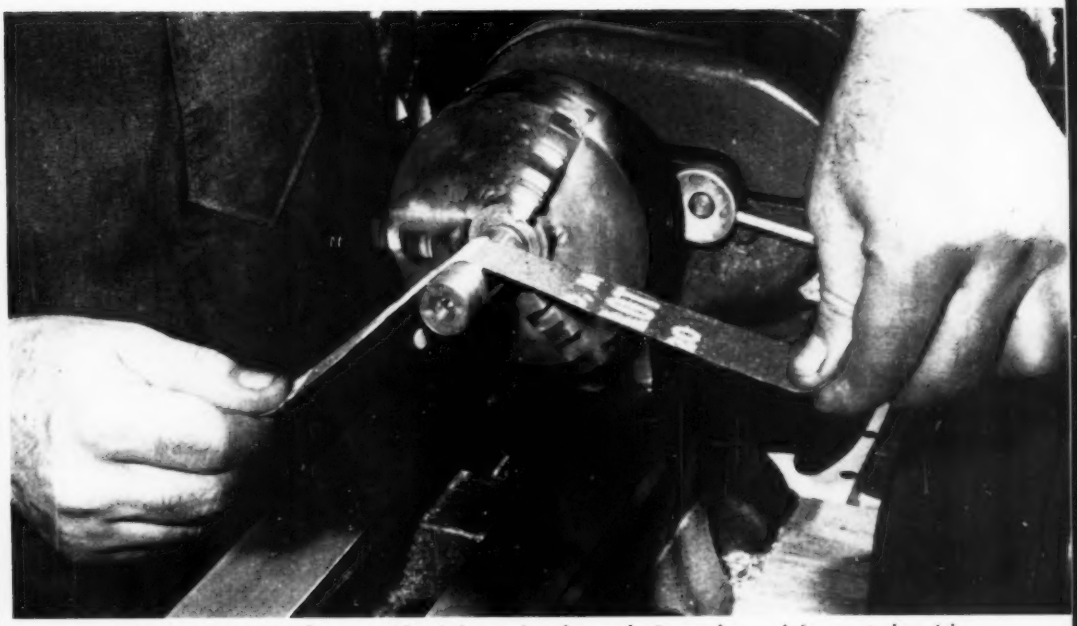
Several auto manufacturers already

CLOGPROOF, the new cloth is ideal abrasive for finishing aluminum and other soft metals.

Around the house, it helps clean up

POT WASHING is easier with a pad-backed square of the cloth to remove stubborn dirt. It does not splinter or rust, as steel wool may.

PAINT SPOTS ON SHOES come off quickly and easily when rubbed with a piece of the cloth saturated with commercial liquid shoe cleaner.



JUST TURN IT OVER when one side of the sand cloth wears down—abrasive covers all parts of the mesh. It can be used for most shop jobs, in place of conventional coated abrasives.

use this new abrasive cloth to wet-sand the prime coat on car bodies. They report a saving of 50 percent in time and 600 percent in the cost of abrasive materials used.

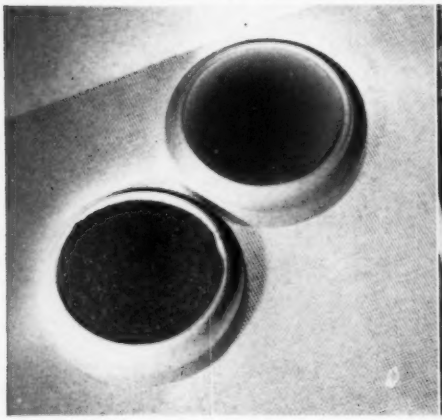
You can use the cloth to make flexible buffing wheels by stacking disks between flanges on an arbor. Such buffers are said to last much longer than abrasive belts and abrasive setup wheels. Around

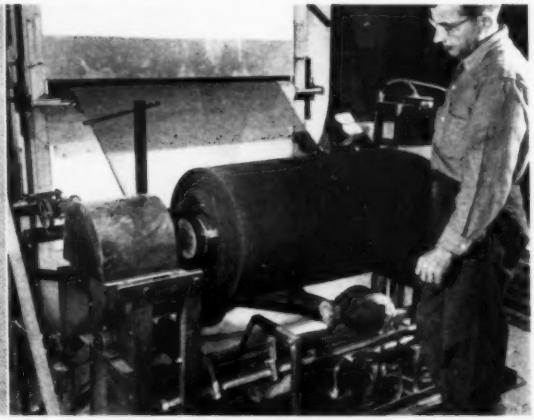
Water makes it more versatile.....

IT'S WASHABLE. When you have finished using a piece of the cloth, you can wash it clean with detergent and warm water for re-use.

IT STICKS ITSELF to some sanding disks—no adhesive needed. Abrasive on back of screen digs into soft disk and holds screen in place.

Continuous process mass-produces new cloth





CLOTH + RESIN + GRIT (above left) make up the new open-mesh abrasive cloth. At Bay State Abrasive plant, specially woven rayon material goes in one end of a long, tunnel-like machine, is coated with resin and grit, then comes out the other end to be rolled up as finished Gritcloth (above right). It is printed with standard grade numbers and cut to size.

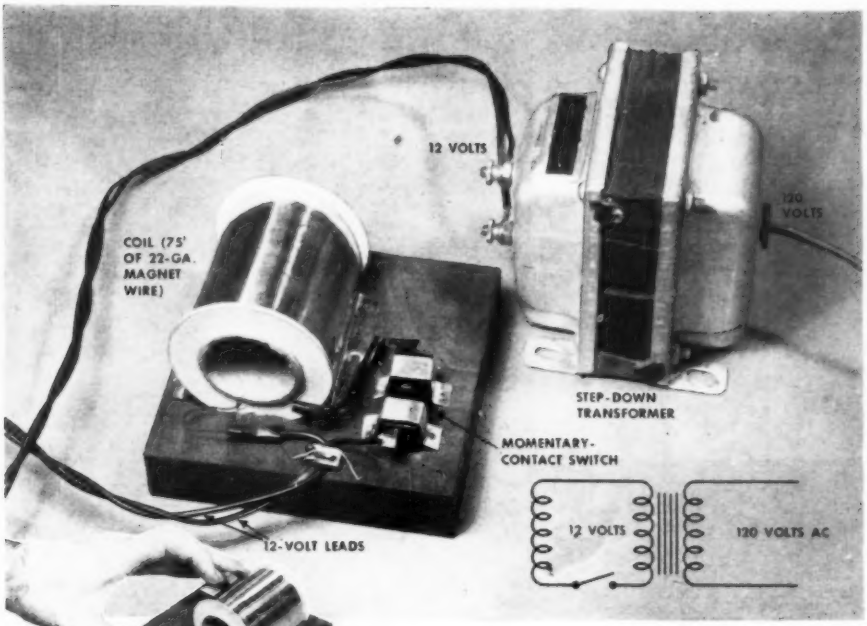
the house, the flexible abrasive can take over many chores now done by steel wool—without steel wool's tendency to rust and splinter. It cleans pots and stoves, renews suede, removes paint spots, gets the shine off that favorite but aging blue suit.

Grit drops on. At the factory of the Bay State Abrasive Products Co., I saw Gritcloth made by a continuous process in a long, tunnel-like machine. The open-weave rayon fabric, impregnated with resin, goes in one end and catches abrasive dropped onto it. Finished abrasive cloth, ready for cutting, comes out. Either aluminum oxide or silicon carbide grit is used, depending on the grade of the cloth and its intended use.

How cloth saves time and money for industry

WET-SANDING CAR FINISHES is biggest industrial application. Users report 50 percent saving on labor, 600 percent saving on abrasives.

FLEXIBLE BUFFING WHEELS for polishing metal parts are made easily by stacking cloth disks on an arbor between metal flanges. END



Shop Coil Removes or Adds Magnetism

MAGNETISM in a shop tool is sometimes useful. But more often it's just a plain nuisance. This solenoid coil will add or subtract magnetism as you wish.

Energize it with a model train transformer having a 12-volt tap or a 10-to-12-volt filament transformer delivering five to 10 amps. Doorbell types are too small.

Glue ½"-wide rings on the ends of a 2½"-long cardboard tube 1" to 1½" in diameter. Wind on several layers of magnet wire and wrap with kraft paper and friction tape. Cut a wide strap from tin-can stock and fasten the coil to a baseboard.

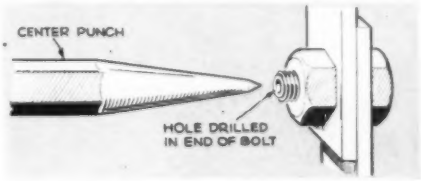
Bring the magnet-wire ends out through holes punched in one of the rings. Solder one wire end direct to a 12-volt transformer lead. A normally off snap switch interrupts the other lead.

To magnetize, hold the tool inside the coil with its end just emerging. Hold the switch closed for a few seconds. If a test shows poor results, do it again.

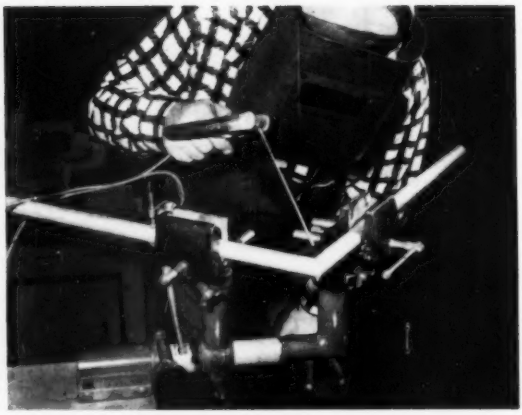
To demagnetize, hold the tool inside and slowly withdraw it while you press the switch. Current kept on more than 15 seconds at a time may overheat the coil.—*Walter E. Burton, Akron, Ohio.*

Expanded Bolt Shank Locks Nut

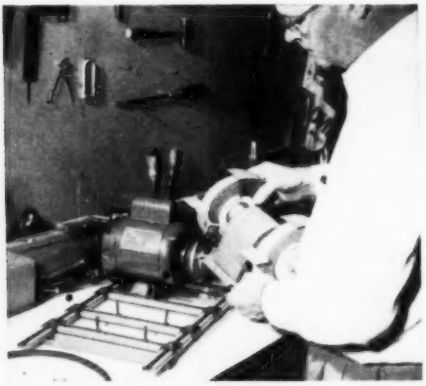
WHERE tension is critical, you can keep a nut on tight by spreading the shank of the bolt. Drill a small, shallow hole in the end of the bolt. Then, after turning the nut on tightly, drive a center punch into the hole that you have drilled.



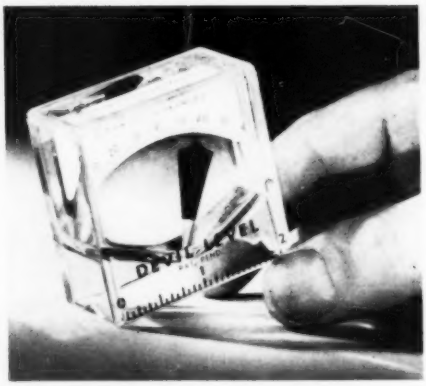
New Tools



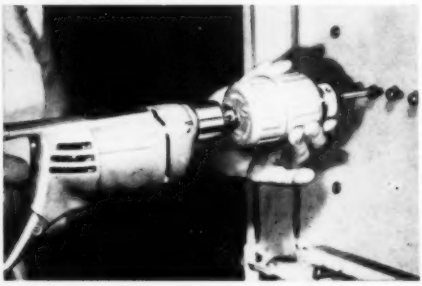
1. Swivel Vises Aid Welding. Like an extra set of hands, these vises hold two pieces of metal rigidly aligned while you weld. They can be separated by as much as 12″, and the vise jaws have a 3″ bite. Both arms swing around the shaft full circle, and the vises also swivel 360° to permit you to weld pieces at any angle.



2. Mount Hitches Motor to Many Tools. Bolt an electric motor or gas engine on one end of this adjustable mount and you can align it interchangeably with a variety of direct- or belt-driven tools and appliances on the other. Switch whenever you like to a grinding wheel, pump, planer or battery charger, using the same motor.



3. Level Gives Degree of Slope. When this oil-filled cube of transparent plastic is tilted, the pointer flicks upright at once. You can read the tilt in degrees on one side and in inches per foot on the other. It will help pitch a gutter or a drainpipe and, if used with a straightedge, will do all the tricks of a spirit level besides.



4. Gearbox for Power Drills. With this unit chucked in a drill you can run nuts, drive screws, and tap or drill heavy stuff. Planetary gears reduce speed, boost power. You can also reverse direction for removing nuts or screws. A Phillips head, a regular screwdriver bit and a square drive adapter for socket wrenches come with the tool.

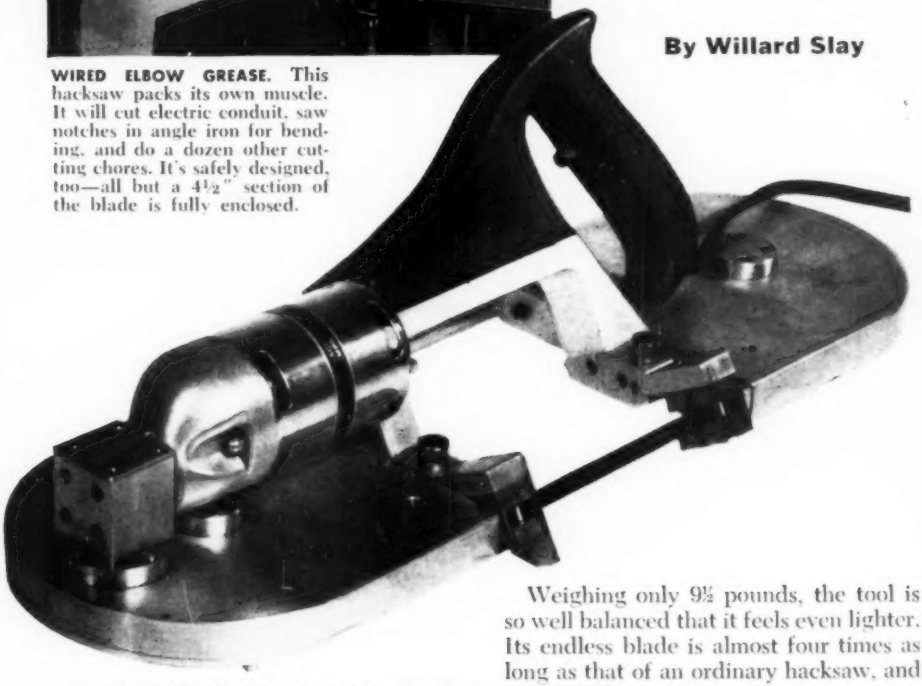
Further information on the tools shown on this page can be obtained from: 1. Welders-Helper, 1346 Meltrose, Modesto, Calif.; 2. Arco Mfg. Co., 1701 13th Ave. N., Grand Forks, N.D.; 3. Laramie Chemical Corp., 16 Putnam Park, Greenwich, Conn.; 4. Supreme Products, Inc., 2222 S. Calumet, Chicago 16.

It's new! It's homemade! This

Electric Hacksaw Cuts Metal Fast

By Willard Slay

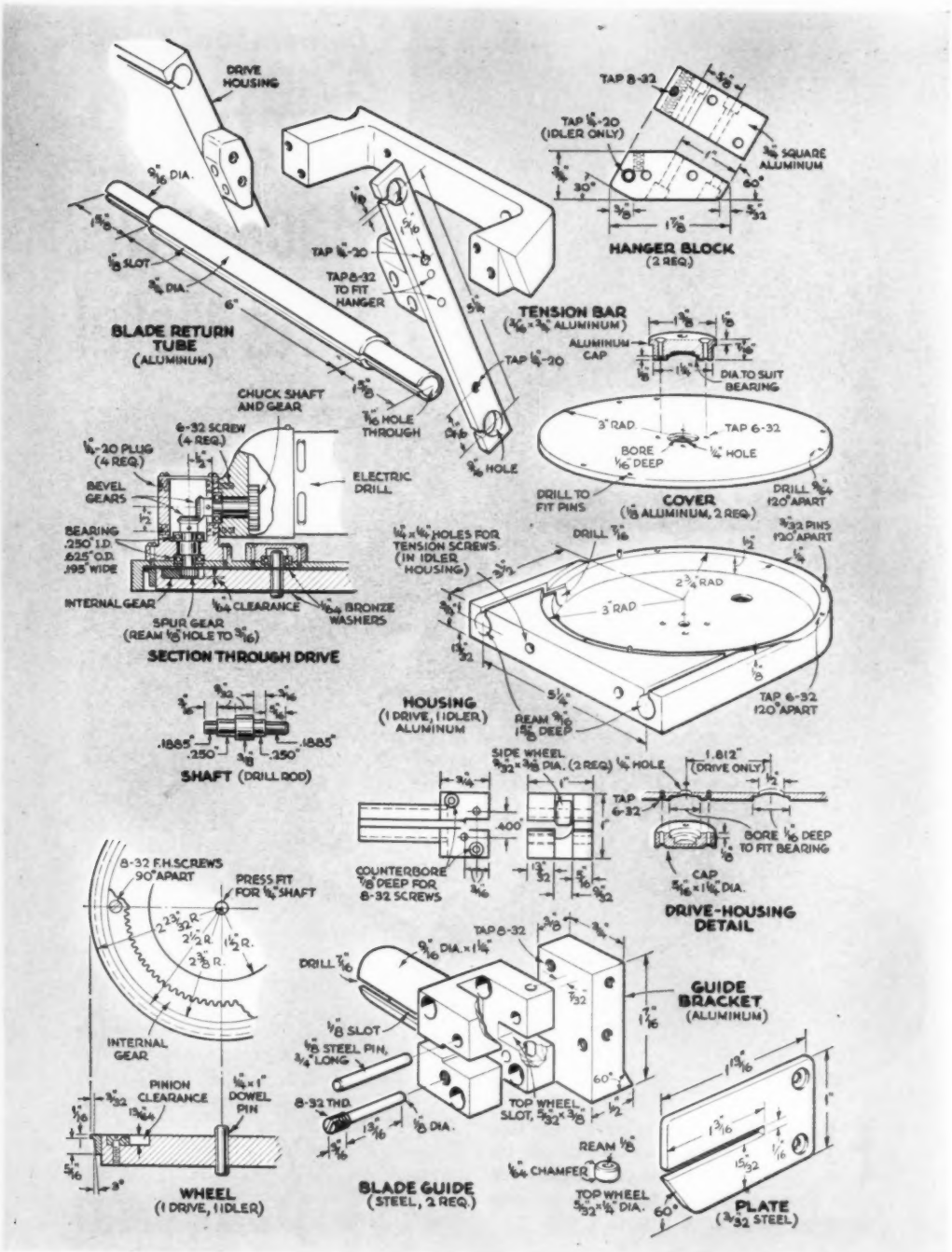
WIRED ELBOW GREASE. This hacksaw packs its own muscle. It will cut electric conduit, saw notches in angle iron for bending, and do a dozen other cutting chores. It's safely designed, too—all but a 4½" section of the blade is fully enclosed.

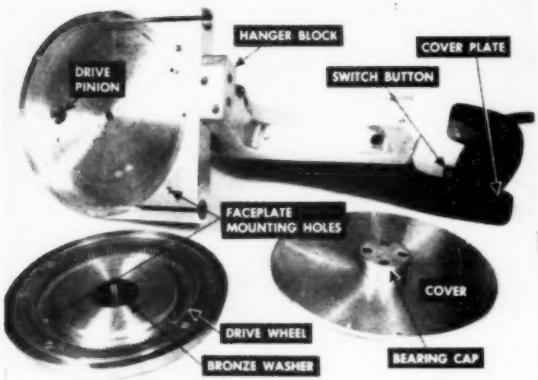


HACKSAWING the pieces for this motor-driven hacksaw should be the last time that you sweat over a hot blade. Once it is built, you can cut metal at the flick of a switch.

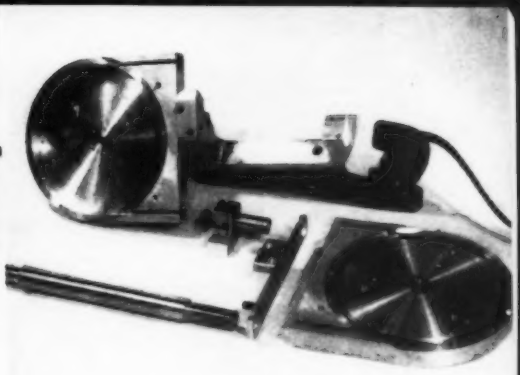
Weighing only 9½ pounds, the tool is so well balanced that it feels even lighter. Its endless blade is almost four times as long as that of an ordinary hacksaw, and every tooth on it cuts.

Two roller guides twist the blade at an angle of 30°. Thus, when the cutting section is held vertically, the return side is tilted upward, clearing stock running


DRIVE HOUSING
9/16" DIA.
1 5/8"
1/8" SLOT
3/4" DIA.
6"
BLADE RETURN TUBE (ALUMINUM)
TAP 1/4"-20
TAP 8-32 TO FIT HANGER
5 3/4"
1 5/8"
7/16" HOLE THROUGH
9/16" HOLE
TAP 8-32
5/8"
TAP 1/4"-20 (IDLER ONLY)
3/4" SQUARE ALUMINUM
3/8"
30°
60°
3/8"
1 7/8"
5/32"
HANGER BLOCK (2 REQ.)
TENSION BAR (3/16" x 3/8" ALUMINUM)
ALUMINUM CAP
TAP 1/4"-20
1 1/8"
1/8"
1 1/4"
DIA TO SUIT BEARING
CHUCK SHAFT AND GEAR
6-32 SCREW (4 REQ.)
1/4"-20 PLUG (4 REQ.)
1/2"
BEVEL GEARS
1/2"
ELECTRIC DRILL
BEARING .250" I.D. .625" O.D. .195" WIDE
INTERNAL GEAR
1/64 CLEARANCE
1/64 BRONZE WASHERS
SPUR GEAR (REAM 1/8" HOLE TO 3/16")
SECTION THROUGH DRIVE
3" RAD.
TAP 6-32
BORE 1/16" DEEP
1/4" HOLE
DRILL TO FIT PINS
COVER (1/8" ALUMINUM, 2 REQ.)
DRILL 9/64" 120° APART
1/4" x 1/4" HOLES FOR TENSION SCREWS (IN IDLER HOUSING)
DRILL 9/16"
3/32"
1/2"
3/32" PINS 120° APART
1/4"
2 3/4" RAD
3" RAD
3/8"
3/8"
13/32"
1/8"
5 1/4"
REAM 9/16" 1 5/8" DEEP
TAP 6-32 120° APART
HOUSING (1 DRIVE, 1 IDLER) ALUMINUM
9/32"
3/16"
3/8"
5/16"
.1885"
.250"
3/8"
.250"
.1885"
SHAFT (DRILL ROD)
SIDE WHEEL 9/32" x 3/8" DIA. (2 REQ.)
1/4" HOLE
1.812" (DRIVE ONLY)
1/2"
3/4"
1"
TAP 6-32
.400"
1/8"
BORE 1/16" DEEP TO FIT BEARING
COUNTERBORE 7/8" DEEP FOR 8-32 SCREWS
3/16"
13/32"
5/16"
9/32"
CAP 5/16" x 1 1/4" DIA.
DRIVE-HOUSING DETAIL
8-32 F.H. SCREWS 90° APART
PRESS FIT FOR 1/4" SHAFT
2 23/32" R.
2 1/2" R.
1 1/2" R.
2 3/8" R.
INTERNAL GEAR
PINION CLEARANCE
1/4" x 1" DOWEL PIN
3/32"
1/16"
13/64"
5/16"
3°
WHEEL (1 DRIVE, 1 IDLER)
TAP 8-32
3/8"
3/8"
9/16" DIA. x 1 1/4"
DRILL 7/16"
7/32"
1 7/16"
GUIDE BRACKET (ALUMINUM)
1/8" SLOT
1/8" STEEL PIN, 3/4" LONG
8-32 THD.
13/16"
1/8" DIA.
3/16"
60°
TOP WHEEL SLOT, 5/32" x 3/8"
1/2"
REAM 1/8"
1/64" CHAMFER
TOP WHEEL 5/32" x 1/4" DIA.
BLADE GUIDE (STEEL, 2 REQ.)
1 13/16"
1"
1 3/16"
1/16"
15/32
60°
PLATE (3/32 STEEL)



THE POWER END has a gear-driven wheel that pulls the blade around. Wheel shafts turn in two ball bearings each—one in the housing, the other in the housing cover. Washers cut from 1/64" bronze are placed between wheels and bearings. The pinion-clearance gap inside the internal gear should be grease-packed.



BOLTED TOGETHER, handle and drive housing form a rigid unit, but the idler housing can slide on the return tube and blade guide when forced back by the tensioning screws. Switch is housed in a recess in the handle. The button is turned with an inside shoulder to retain it. A cover plate closes the recess.

past it. The hacksaw will cut 2¼" deep.

Power is supplied by the motor and gear train of a small, inexpensive electric drill* permanently built in. The other gears required are standard ones, available by mail from the manufacturer.** Building the tool requires the use of a metal-turning lathe with at least a 9" swing.

Making wheel housings. Cut two pieces of ¾"-by-6" aluminum bar stock slightly over 6½" long. On a 3½" radius and 1⅝" in from the long sides, drill and tap four holes ¼"-20. Use bolts in these to clamp the stock to the lathe faceplate, centered across the 6" width, but ¼" off center as to length.

Bore the 5½" inside diameter ⅝" deep. Then turn the cover-plate seat ⅛" deep. Centerdrill, run a ¼" drill through, and ream .002" larger for shaft clearance.

Reverse and reclamp each housing on the faceplate, using an indicator to center the shaft hole. Then counterbore this hole $\frac{1}{16}$" deep for a light press fit for a ⅜"-o.d., $\frac{5}{16}$"-wide ball bearing.

On the drive housing, you can use the cross-feed collar to set off the 1.812" dimension for the pinion bearing. Bore this ½" and counterbore it also for a ⅜" ball bearing. If the lathe won't swing the housing this far off center, set it up on the drill press and use a spot-facing tool or fly cutter to machine the recess.

Clamp each housing to the drill-press table accurately (or centerdrill what will be the rounded edge for line-drilling against the lathe tailstock). Run a ⅛" drill through from each corner of the other edge into the 5½" bore, enlarge through to $\frac{5}{16}$", and open to $\frac{9}{16}$" for a depth of 1⅝".

Either mill out, or drill a series of holes and file out the slots into which the blade will be threaded. Then cut off the outer corners of both housings and round them to the 3" radius.

Aligning covers. Rough the housing covers out of ⅛" aluminum. Bore and ream the shaft hole and recess it as in the housings. Then clamp each cover on a stub arbor to turn the outside. If the lathe has an indexing head, use it to lay out the holes for the screws and dowel pins around the edge.

Next, turn and bore the bearing caps. Use these, a ¼" dowel pin, and two bearings to align covers and housings. Clamp each cover in place so that the pin can turn freely. Then drill through the cover holes to spot matching ones in the housing. Use a bearing to align each cap when drilling mounting holes for it.

Machining the wheels. You can use solid steel or cast iron for these, but the ones shown were made of aluminum

*Drill 520, made by Fairchild Industries, Inc., Burlington, Vt.
**Boston Gear Works, 3200 Main St., Quincy 71, Mass.

with steel tires to reduce weight. Drill and tap three or four holes in the stock on a 1¾″ radius for faceplate mounting.

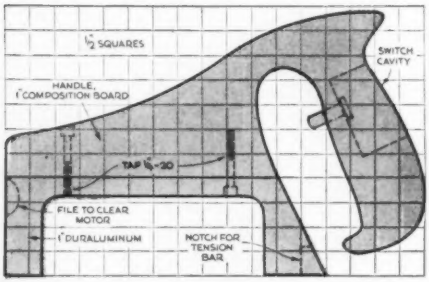
For two-piece wheels, first saw the flange from ⅜″ flat cold-rolled steel and bore it .004″ less than 5″ diameter. Turn the wheel rim to 5″, cool it below freezing temperature, and heat the steel tire. If the two parts are carefully aligned before they are brought into contact, they will drop together and become virtually one.

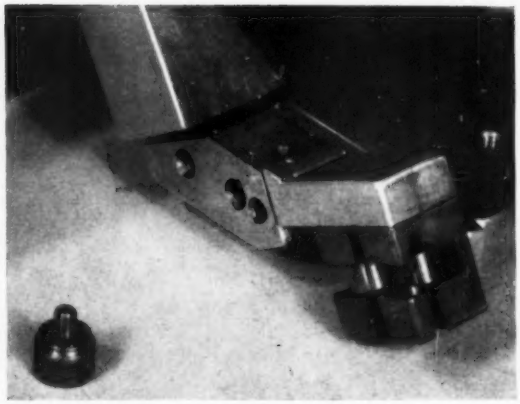
Remount the wheels to turn the flange and the 3° taper on the rim, and to drill and ream the center hole to a press fit for the shaft (.249″). In the drive wheel, turn the recess for the internal gear (Boston G-669). The recess is ⅞″ wide to give running clearance for the pinion.

Mounting the drive unit. The electric drill that powers the saw is mounted upside down on the drive housing. The gear case of the drill is cut short, faced off, and counterbored $\frac{3}{32}$″ deep for a ball bearing. This bearing aligns the gear case with the bevel-gear housing, which is similarly counterbored.

The bevel-gear case can be made by facing off a 1¾″ length of 1¾″ aluminum bar on four sides, leaving a mounting flange the original diameter. Bore through ½″, counterbore ¾″ to a depth of 1⅛″, and bore a bearing seat inside. Reverse and mount the piece in the four-jaw chuck, indicating the ½″ hole to bore the outer or bottom bearing seat, which receives the bearing set into the top of the drive housing. Finally, rechuck the piece at 90° to bore the seat for the ball bearing that the drill shaft will run in.

From the opposite side, drill through



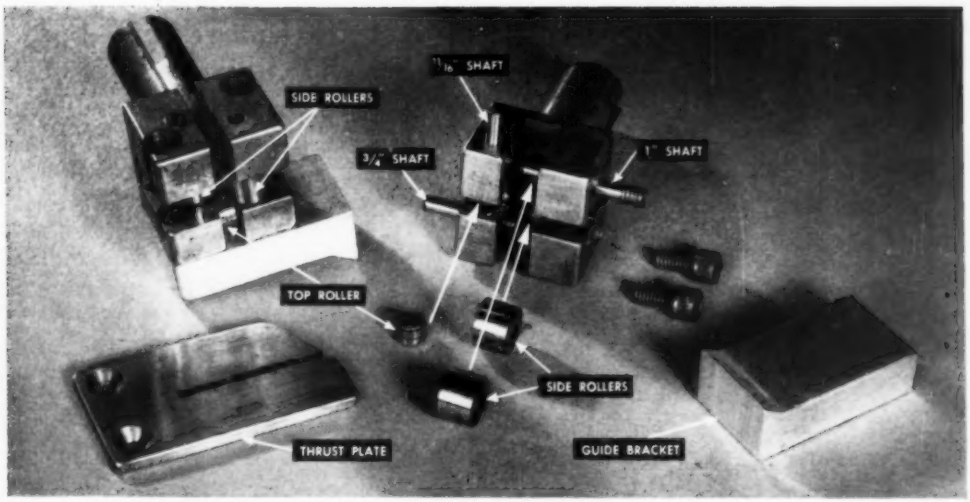


SLIP BLADE GUIDES into the holes in the wheel housings. Leave them straight until the blade is in position. Then twist both guides to 30° as shown here (the blade has been omitted to show the rollers). With the foot of the guide bracket against the hanger, lock guide in this position by screwing knurled-head 8-32 screw (above left) into the hanger.

both walls for 6-32 screws tapped into the drill housing. Then open out the same holes in the forward wall, tap them ¼″-20, and plug them with headless setscrews after the parts are assembled. Use the lower ball bearing to align the gear case on the drive housing when spotting the mounting holes from its flange.

The drive shaft should be held closely to the specified diameters for a good fit in gears and bearings. The gears may be pinned if necessary. The spur gear or pinion (Boston G-163) comes with a ⅛″ hole which must be reamed out to $\frac{3}{16}$″. If the ½″ dimensions specified are closely held, the bevel gears (Boston G-462) should mesh well. Correct excessive backlash with shims or washers. Pack the drive-wheel recess with a good grade of gear grease.

Joining the pieces. A handle bracket cut from 1″ dural or other light alloy bridges the wheel housings. Attach it directly to the drive housing by a hanger block made of ¾″ square stock, and to the flat tensioning bar by a similar hanger. Before mounting these on drive housing and tensioning bar, join the two housings with the blade return tube and



BLADE RUNS BETWEEN the two wide rollers in the guides, at a speed of 120 to 150 feet per minute. The top edge of the blade runs against the small roller, which takes thrust of cutting pressure. Dimensions are such that the blade teeth never touch side rollers.

find the center of balance, which will be off center toward the left as shown. Then mount the hangers at this point.

Fitting the blade guides. Mount 1" square cold-rolled steel in the four-jaw chuck. Turn to $\frac{9}{16}$" diameter for a length of $1\frac{1}{4}$", and bore out to $\frac{7}{16}$" slightly deeper.

Drill and ream the holes in the square head before slotting it, so that the drill will not be led off center by striking a second surface. The holes for the 8-32 socket-head cap screws are counterbored deeply, to within ⅛" of the opposite face. Take pains to locate the ⅛" holes for the side rollers just .400" apart, so that the blade gap remaining between the rollers will be exactly .025".

Mill the slots if possible, or drill, saw and file them out. Two of the roller shafts in each guide are plain ⅛" drill rod, ¾" and $\frac{11}{16}$" long. The third one is turned from larger rod, threaded and slotted. Turn the rollers also from drill rod. Harden them and the shafts by heating cherry red and quenching in oil. Then temper by leaving the parts in the kitchen oven at 350° for an hour.

To assemble the guides, insert the top roller and its shaft. Then put in the side roller nearer it. Mount the guide bracket and finally the last roller and its shaft.

Weld blade to size. With the saw assembled and the tension bar about ⅛" from the idler housing, measure around the wheels with a steel tape. Order a .025"-thick, ¾"-wide blade made up to this length (any machine shop having a metal-cutting bandsaw can do the job).

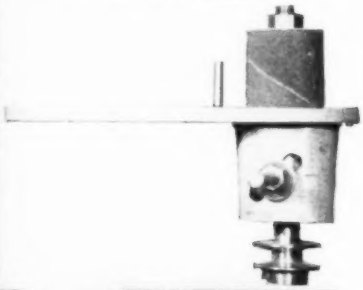
Clean the blade and wheel rims with solvent to remove all oil. With the idler housing close to the tension bar, slide the blade on the rims and into the return tube and guides. Then twist the return tube so as to enclose the blade, and carefully tighten the two tension screws, first one and then the other, to draw back the idler housing evenly. Do not tighten the blade excessively; it should slip on the wheels rather than stall the motor if the teeth jam in a cut. END

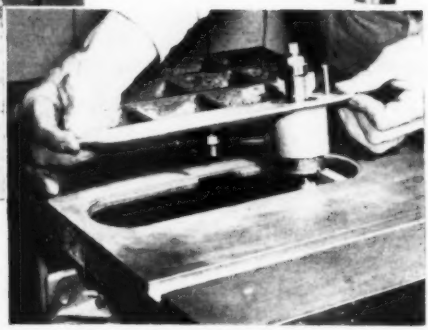
HINT TO AN UNHANDY HANDY MAN

Would you save yourself troubles
And cuts beyond number?
Pull out all the nails
When you're using old lumber.

—Berton Braley

MAKING MOLDINGS, as at left, is one of the jobs that can be done on a table saw with this shaper attachment which takes any standard ½"-bore cutter or any standard molding-head cutter. The unit, shown below with a sanding drum, has built-in height adjustment.





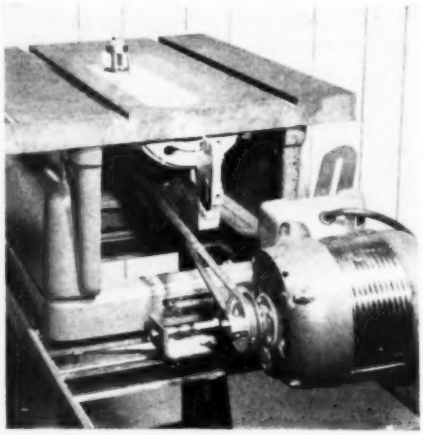
AFTER THE SAW BLADE AND INSERT are removed, the unit is set into the opening and clamped in place by means of a bracket on the underside.

New Unit Makes Saw a Shaper

SHAPING on a home-workshop table saw is possible with a new universal shaper attachment.* You install it in place of the table insert and saw blade. It will do the same work as a shaper head on a drill press. In addition, it gives you the full area of the saw table as working space.

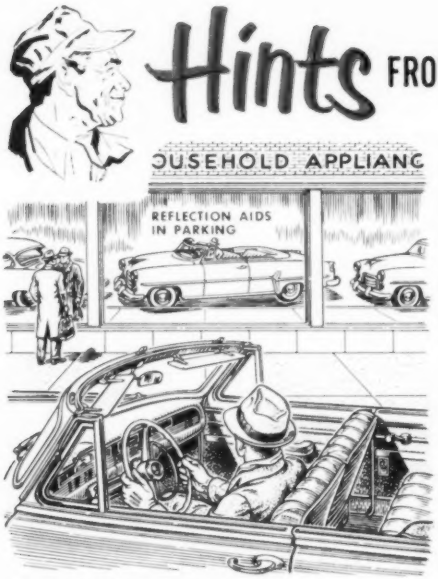
Locked by a bracket to the underside of the table, the attachment consists of a plate on which is mounted a vertical spindle. Its pulley is connected by direct-drive belt with the saw motor. An adjusting arm on the spindle will raise or lower the cutters ¾" and can be locked in any position. Work can be guided against a stop pin inserted either behind or ahead of the cutters, or it can be fed along the fence. The attachment is made in sizes to fit seven saw models including the 8" Atlas, Craftsman and Delta.

*Lee Tool Co., Box 12, Galesburg, Ill. Price $19.95.

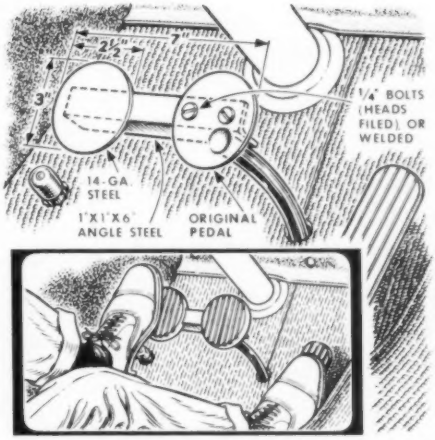


A 90° TWIST OF THE BELT and adjustment of the motor adapts the unit for work. Remove the splitter and guard to get full use of the table.

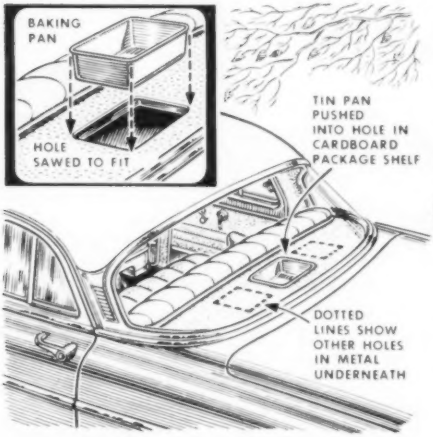
Hints FROM THE MODEL GARAGE



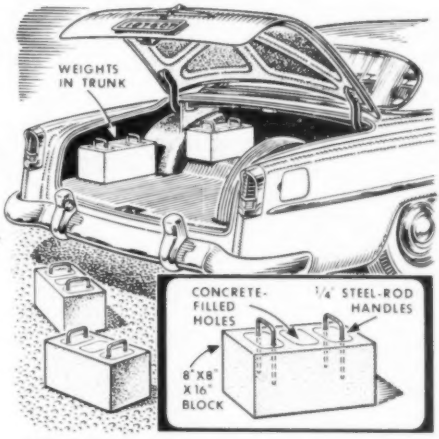
Parking downtown in a too-short space won't be a wrestling bout with your steering wheel if there's a store window opposite your parking spot. You can usually see from the reflection how your car lines up with those on either side of you.



A two-footed brake pedal is a real convenience on an automatic-shift car. This sketch shows an extension that puts the pedal within easy reach of your left foot. Weld an extra pedal to the extension. A dealer will sell you a pedal pad.



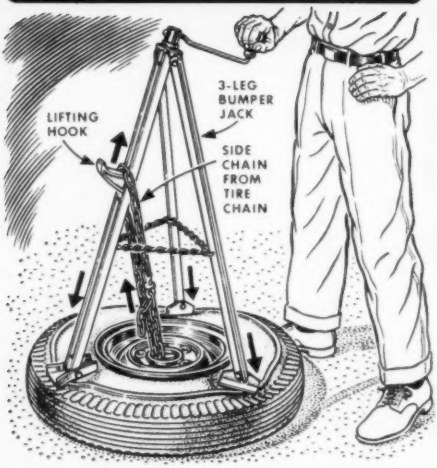
Small objects won't roll around if you set a baking pan into the package shelf. The sheet metal under the cardboard of the shelf usually has several holes to reduce weight. Locate one and cut the cardboard to fit the pan so that it drops into place snugly.



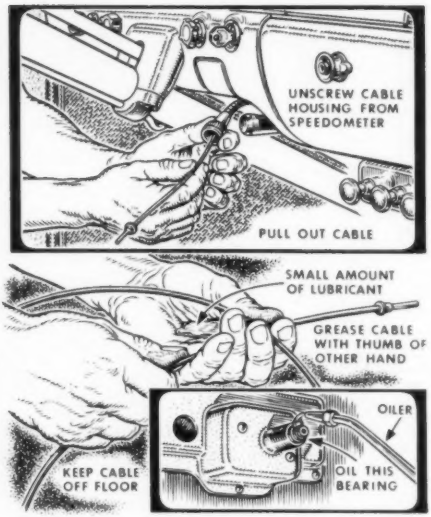
Weights in the trunk will add traction to the rear wheels, especially in a car that has its weight concentrated at the front. For winter driving, heave in several concrete blocks. Rods set in the blocks will make them a lot easier to handle.

Please turn the page for more auto hints

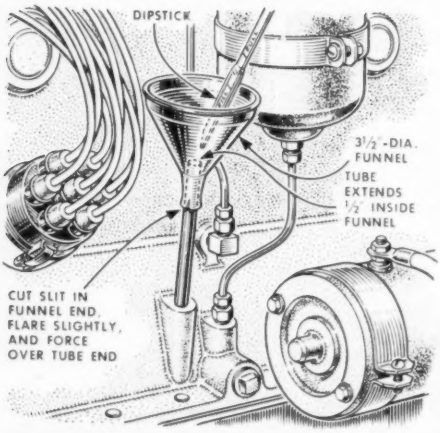
MORE Hints from the Model Garage



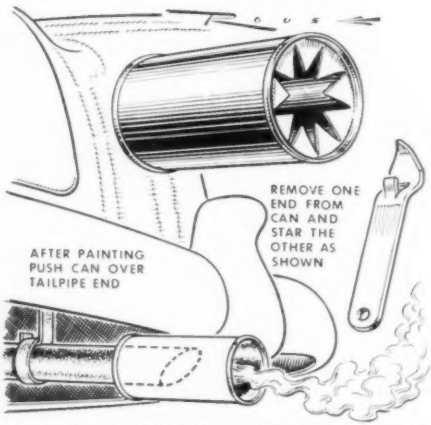
Breaking a frozen tire bead with a jack is an old trick. But here's that stunt in new form, using a tripod jack. Run a sling—an old tire chain or towline rope is fine for this—through the wheel hole, between the lifting hook on the jack and a cross-piece set under the wheel. Cranking will cause the legs to force the bead away.



A jiggling speedometer needle, accompanied by whirs and ticks, is a signal that your speedometer cable needs lubricating. It's recommended every 10,000 miles in any case. Rub light graphite grease on the cable—sparingly within 6″ of the speedometer-head end. And put a few drops of oil on the bearing at the back of the head.



Dipstick tubes are hard to see in a dark garage. You can end fumbling—and greasy sleeves—with a small funnel. Cut a short slit in the spout of the funnel and force it over the tube as a guide. Remove the funnel occasionally and wipe it clean.



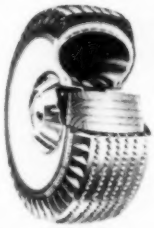
A no-cost tailpipe extension can be made from a beverage can. Remove one end of the can and make notches in the other, cutting them so closely together that a star-shaped piece of metal drops out. Push tabs back up and shove jagged end on tailpipe.

New for Your Car

1. Trailer Fits in Car Trunk. Designed to knock down in 60 seconds and tuck into the trunk, as at right, this 90-lb., all-steel, one-wheel utility trailer will carry a load much heavier than the two men shown standing in it. You hitch it with two metal straps.

2. Windshield Cover Keeps Off Snow. Snap fasteners on elastic tape snug this plastic cover against the windshield to keep off snow and sleet while you are parked. The tapes slip around the door posts and snap together inside the automobile.

3. New Improvements for Tubeless Tires. Longer wear and greater blowout safety are being built into the new tubeless tires. Seiberling Rubber does it (top right) with an added nylon breaker ply and new sealant under the tread; Goodyear (below) with a nylon shield that leaks reserve air slowly if a blowout lets the air out of the main tire chamber; and U. S. Rubber (far right) with two layers of crisscross wires worked into the tread to resist cuts.



Further information on these new car products can be obtained from: 1. West Coast Products Co., 938 N. Fairfax Ave., Los Angeles 46; 2. Cardinal Products Co., 15614 Detroit Ave., Cleveland 7; 3. Seiberling Rubber Co., Akron 9; Goodyear Tire & Rubber Co., Akron 16; U. S. Rubber Co., Rockefeller Center, NYC.

Drop those gouges and chisels! You save both time and work by

Carving Wood With a Drill Press

By Dick Hutchinson

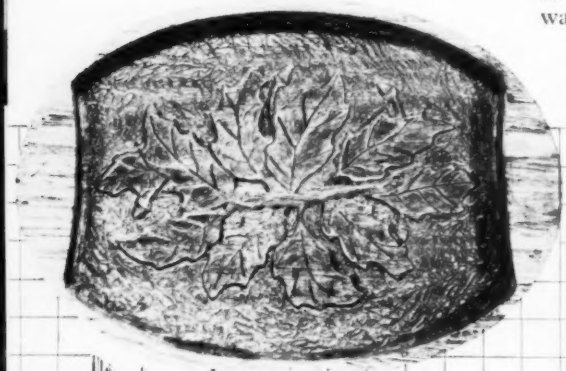
MUCH of the slow handwork in wood carving can be eliminated by using a drill press. The tray at the left shows what you can do.

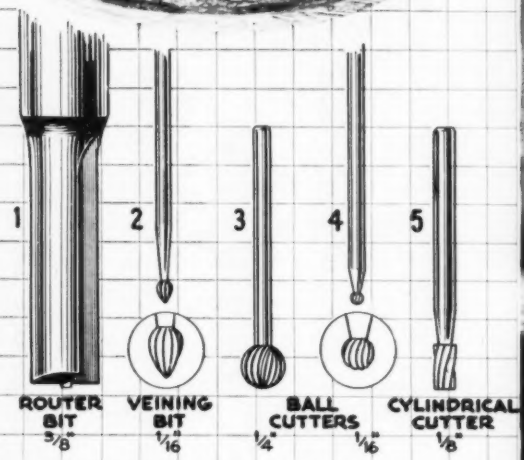
It is a little less than 12" long and was carved from ¾" white oak. If you prefer a larger tray, enlarge the squares when you scale up the pattern.

After sawing out the blank, I set up the drill press with a ⅜" router bit. A wood strip clamped to the table served as a work guide while the center of the tray was being routed out, the spindle being locked for a cut 7/16" deep.

I then smoothed up the bottom of the cut with a 4" disk sander, also chucked in the drill press. This step is not essential, as the router leaves the surface smooth enough for the final carving.

Carving the design. After I had transferred the design to the tray surface, I was ready for the carving. Chucking a





POWER CARVING makes light work. Use these common bits and cutters in the order shown.

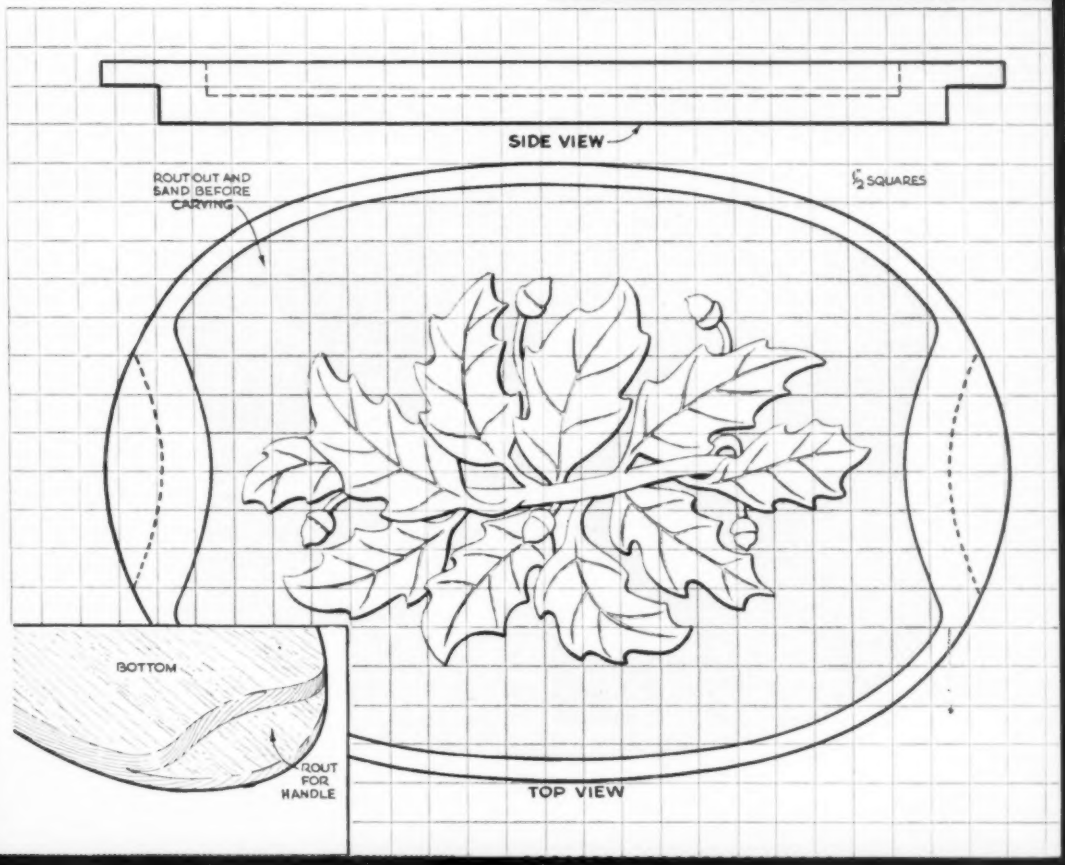
ROUTER BIT removes waste material. It is also used to shape the handle recesses on the underside of tray. Note guide strip.

pointed 1/16″ bit and locking it for the desired depth, I first outlined the leaves and acorns. Then I raised the cutter slightly and cut the veins in the leaves. It's easy to guide the work so that a small cutter like this will follow a line very closely.

Two ball cutters were then used in succession, the ¼″ to carve the background, and the smaller one to round the edges of the leaves slightly and shape the branches and acorns.

Final touches. With the ⅛″ cylindrical cutter in the chuck, I grasped the tray in both hands, rested my forearms on the drill-press table and worked over the face of each leaf freehand, removing just enough of the wood to give the leaves a natural depth.

I smoothed the carved surface with sandpaper and fine steel wool, then applied a coat of chocolate-brown semi-gloss oil paint. I wiped this off immediately, and finally applied two coats of clear shellac.



Rounded Cleats In Notches Hold Shelves

If you install shelves on cleats when making a cabinet, you might like to do it this way.

Bore a centered row of holes in a ½"-by-1½" strip, rip the strip down the middle and use each half as an upright to support round-end cleats as you see in the assembly in the foreground at left. Or clamp two strips together and bore the holes.

Steel-Wool Pad Run on Drill Bit

Cleaning rust off metal objects can be done effortlessly by wrapping a steel-wool pad around a bit chucked in an electric hand drill or drill press. Cover the shaft completely. You can polish or buff this way, too.—*Tom Martin, Bedford, Va.*

Hole in Hammer Clinches Nails

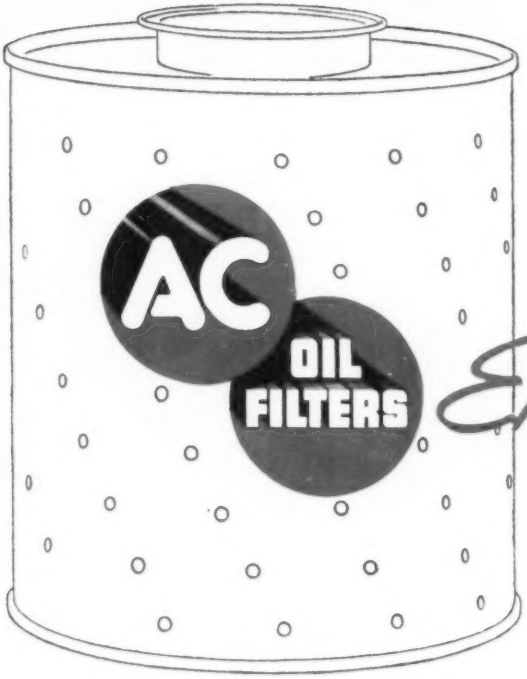
A hole in the head of a hammer makes a good tool for nail-clinching. Drill a 9/64" hole ½" deep diagonally between claw and eye of the hammer, using a slow drilling speed and plenty of cutting oil.

Drill Cord Made Tangleproof

A telephone retractor coil over the cord of an electric drill will keep it from snarling other tools on the bench. Added bonus: It winds automatically for storing.

Good Trick for Metalworking

The next time you rough-cut on a lathe, grab an old shirt or shop coat off the wall and slip it on backwards. It will keep hot chips from going down your neck.



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AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS

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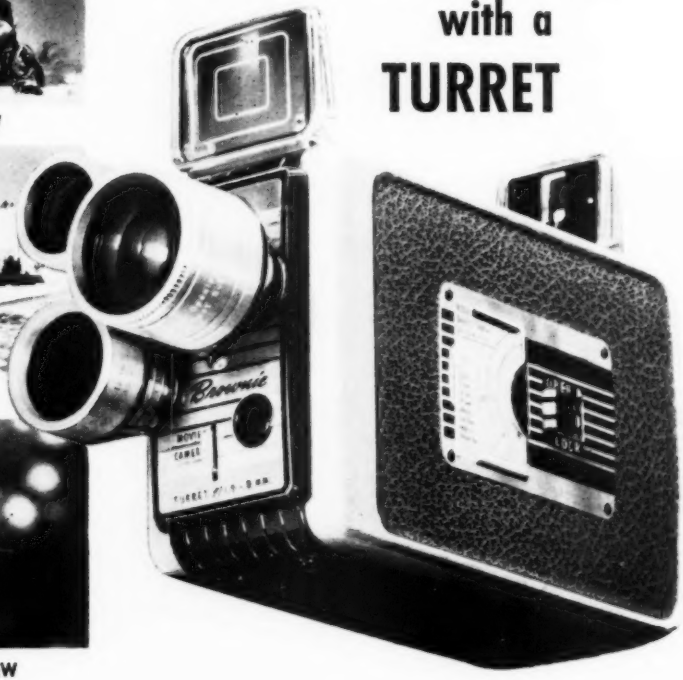

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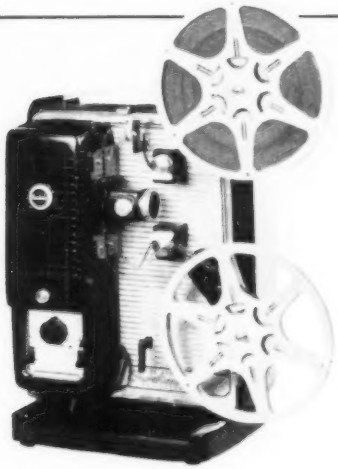
- All 3 lenses shoot as fast as *f*/1.9.

Cine-Kodak Medallion 8 Camera

No bigger'n a minute, the Cine-Kodak Medallion 8 Camera has the look, feel, and "purr" of a finely built watch. Takes but 3 seconds to load it with a magazine of film; little more to switch from indoor to outdoor color. Fast *f* 1.9 Ektanon Lens focuses down to 12 inches for close-ups, is directly interchangeable with all "D-thread" type lenses. Optical finder adjusts to show fields of lenses from 6½mm to 38mm. Speeds of 16 to 48 frames per second, plus single-frame. Continuous run lock; ready-set footage counter. It's an easy-to-use little gem—yet the Medallion 8 Camera comes packed with the kind of features every serious movie maker wants. **$144.50**

NEW Biggest little 8mm magazine camera ever!

NEW Brighter, big-screen 8mm movies!



Cine-Kodak Showtime 8 Projector

Years ahead in design—a Cine-Kodak Showtime 8 Projector will actually give you sparkling, big-screen color movies up to 5 feet wide—*or larger*. Threading, focusing, framing, and tilting are unusually simple . . . positive. A lighted switch panel gives you finger-tip control of "still-picture" projection, comic reverse action, fast rewind. Reel arms accept 400-foot capacity reels for a full half-hour show. Fast *f* 1.6 Lumenized lens . . . a new shutter and pull-down system transmits 60% more light for extra-big, extra-bright pictures. Truly the surest-operating 8mm projector Kodak has ever produced. Complete with built-in case. **$115**

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Kodak
TRADE-MARK

Prospecting for jigsaw ideas? You'll strike pay dirt with this

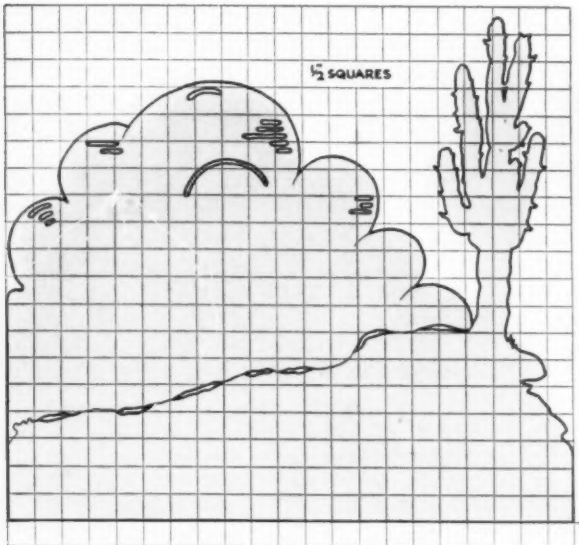
Forty-Niner Cactus Planter

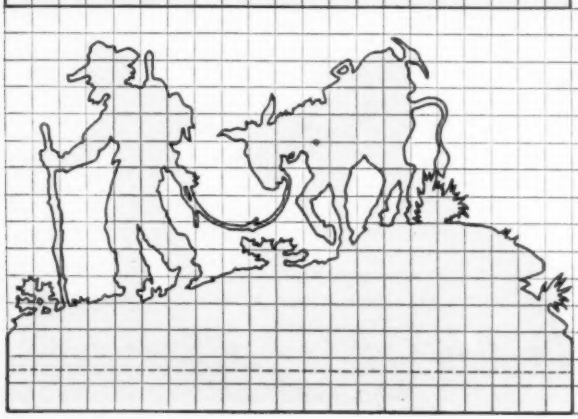
HERE'S a project that's bound to be a popular gift for your green-thumbed friends. The only materials that you'll need are a 10½"-by-17" sheet of .025-gauge aluminum or copper, and a 10½" length of ¾"-by-7" hardwood.

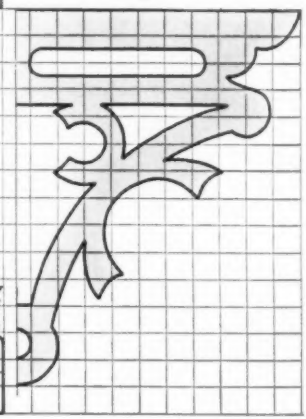
Scale up and complete the half pattern of the scrollwork that you see at the bottom of this page. Then transfer it to the hardwood and run off the scrollwork on a jigsaw. Sand, stain and wax it, then form the flowerpot bracket from a ½"-wide strip of .025-gauge stock. Attach to sconce with ½" round-headed screws.

Scale up and transfer the other drawings to the sheet metal. Cut out the silhouettes with a fine jigsaw blade and

[*Continued on page 238*]







MEN WITH MECHANICAL SKILLS:

CAN YOU MEET THIS CHALLENGE?

Mechanics Creed

Upon my honor I swear that I shall hold in sacred trust the rights and privileges conferred upon me as a certified mechanic. Knowing full well that the safety and lives of others are dependent upon my skill and judgment, I shall never knowingly subject others to risks which I would not be willing to assume for myself, or for those dear to me.

In discharging this trust, I pledge myself never to undertake work or approve work which I believe to be beyond the limits of my knowledge; nor shall I allow any superior to persuade me to approve aircraft or equipment as airworthy against my better judgment; nor shall I permit my judgment to be influenced by money or other personal gain; nor shall I pass as airworthy aircraft or equipment about which I am in doubt, either as a result of direct inspection or uncertainty regarding the ability of others who have worked on it to accomplish their work satisfactorily.

I realize the grave responsibility which is mine as a certified mechanic to exercise my judgment on the airworthiness of aircraft and equipment. I, therefore, pledge unyielding adherence to these precepts for the advancement of aviation and for the dignity of my vocation.

If you are a man who takes real pride in a job well done, the Air Force offers you a challenging and rewarding career. The safety of our country, and the lives of its defenders, depend on your accuracy and devotion to duty. Act today and put your skills to work tomorrow—in the U. S. Air Force.

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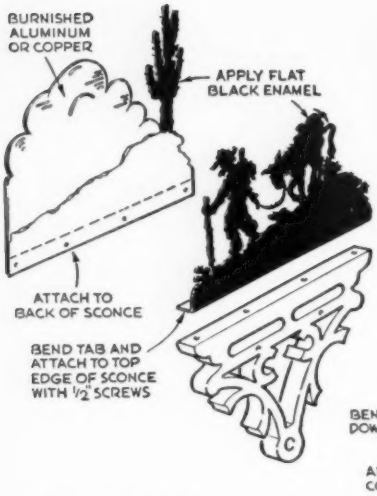
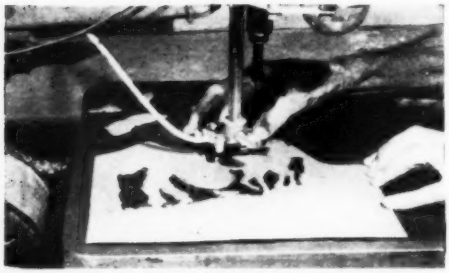




LIGHT SHEET ALUMINUM is used for cutting out the man and donkey (above) and background.

[*Continued from page 236*]

clean up any rough edges with pattern files. Fold the prospector-and-burro silhouette inward along the dotted line to form a base tab. Drill holes in tab for screws. After giving the cutout a coat of flat black enamel, attach it to the sconce.

Burnish the cloud area of the other silhouette and paint the cactus black. Attach this cutout to the back of the sconce. Drill two holes in the metal of the background silhouette just above the sconce for the screws or hooks which attach the planter to the wall.—*Richard Garland, La Porte, Ill.*

Calking Cord Has Many Uses

A SMALL amount of calking compound kept within easy reach on your workbench comes in handy for such jobs as plugging holes and positioning rods or wires for soldering. You'll find other uses for it, too.

Shade Bracket Hangs Parts Jar

A WINDOW-SHADE bracket bolted to the screw top of each jar containing nails, washers and other small parts will let you hang them on a perforated board along with your tools. Use outside-type brackets, attaching them far enough in for the nuts to clear the rims when the lids are screwed down.

Engineer's Report:
1956 CHEVROLET

Behind Chevrolet's record-shattering Pikes Peak climb are important engineering changes

by **ED COLE**, *Chevrolet Chief Engineer*

Since Chevrolet's record-breaking run up Pikes Peak, people have asked me just what we've done to this new Chevrolet to make it the mountain-climbing champ.

Well, to begin with, our job was to produce a car that would out-perform last year's Chevy which, you'll recall, was the leading winner on the stock car tracks. That was a big order.

Our men started by making refinements in the "Super Turbo-Fire V8" engine. They raised the compression ratio to 9.25 to 1. Horsepower was boosted to 205. You can imagine what these changes did for performance!

Next we went to work on the "Blue-Flame" 6. The compression ratio went up to 8 to 1. Horsepower was increased to 140. The final result of these and other improvements is the most powerful, sweetest running 6 we've ever had in a Chevrolet passenger car!

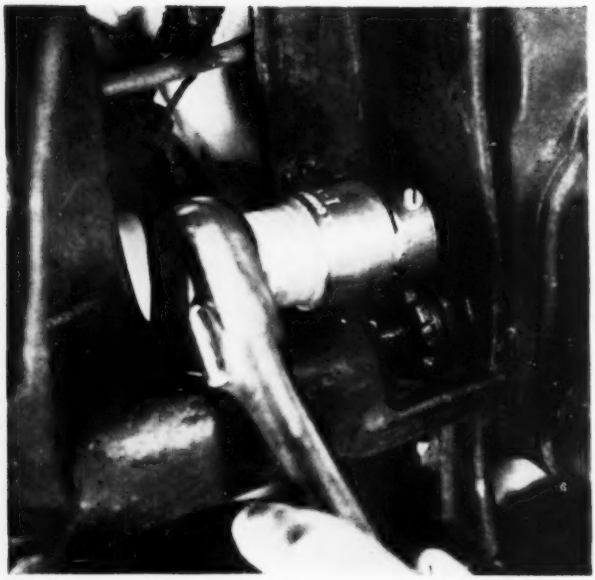
Drivers who like a full-flow oil filter will be pleased to hear that we've made provision for one on our V8 engines. And *all* engines—both 6- and 8-cylinder—are now equipped with Hydraulic-Valve lifters. This eliminates the need for periodic valve adjustments.

Drop by and drive this record-breaking new Chevrolet at your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Chevrolet

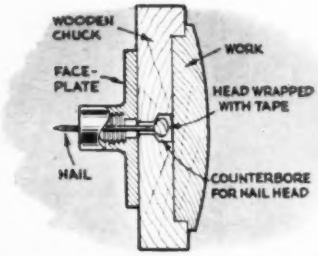
1956 Chevrolet setting new record for Pikes Peak climb

NEW Shop Ideas



Close-up Die Driver. This can save the day when you have to re-thread a stud in tight quarters. Instead of needing room to swing a die holder, you need only enough to work a ratchet-wrench handle.

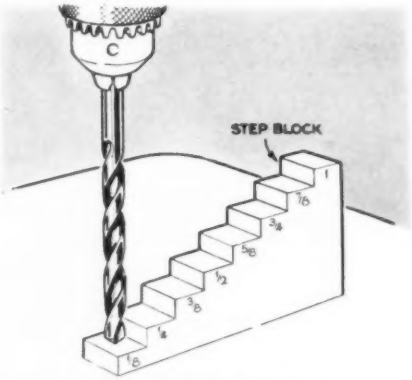
Turn a cup to fit your regular dies, tap it for a locking screw, and drill it through to clear the biggest studs you're likely to meet. Center a nut on it and weld it.—*Phil McCafferty, Stanwood, Iowa.*



Knockout for Turnings. Work turned in a wooden chuck is easily marred when pried out. To make removal safe and easy, bore a hole in the chuck, wrap a flat-headed nail with rubber tape and push it into the hole before you mount the work.

When ready to remove the turning, unscrew the faceplate and tap the nail with a hammer.—*Paul Swanson, Flint, Mich.*

Shop Use for Diving Mask. A skin-diver's mask will serve as goggles for grinding, rough sawing, and other jobs in which chips fly. It protects the eyes even at the sides.—*Walter F. Neiland, Lowell, Mass.*



Stepped Block Sets Depth. A stepped metal or hardwood block will speed up setting the drill press for drilling or routing to an exact depth. The desired step is placed beneath the drill or bit. Then the stop gauge is set, or the table lowered so that the tool just touches the step at the bottom of spindle travel.—*Charles H. Willey, Penacook, N.H.*

Please turn the page for more shop tips

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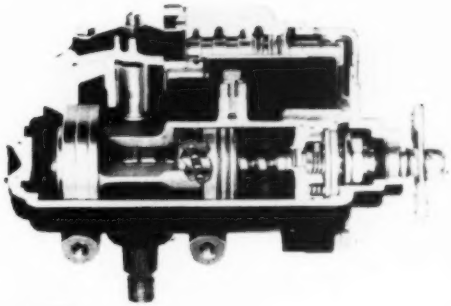

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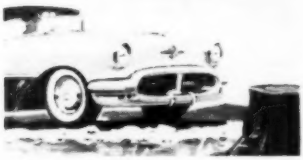

2 GREATER ROAD STABILITY. New system helps hold car "on course"—assures even more secure "road feel" than ever.

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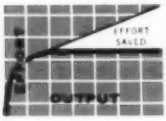

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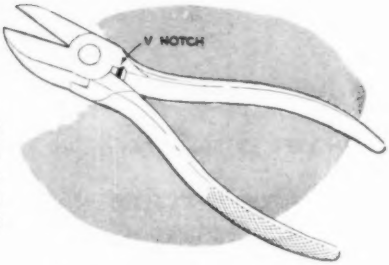
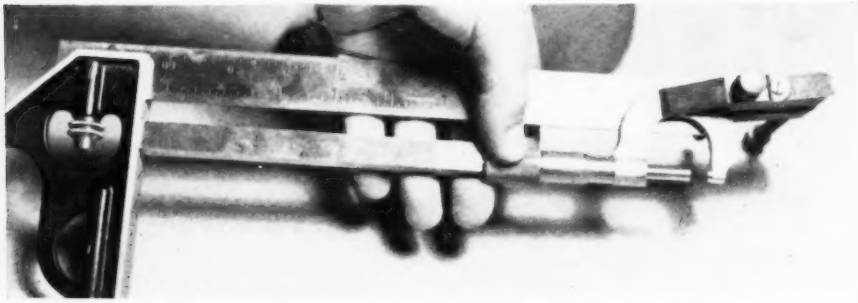
MORE SHOP TIPS



Pin Grip for Pliers. An extra notch makes any pair of pliers or cutters even more useful for such jobs as pulling pins, holding small rods, and bending wire. Simply file a V notch inside one handle, as close as possible behind the pivot pin (right). You will find that the short fulcrum affords tremendous gripping power.

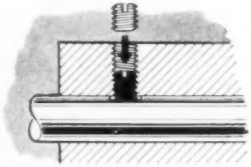


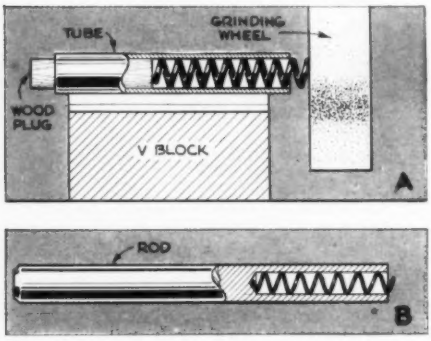
Gauging Long Work. An ordinary 1″ micrometer can be used to measure work several inches long. All you need besides is a combination square and either a standard rod no more than 1″ longer than the work, or an inside micrometer the same size.

Clamp the outside mike to one end of the square, its spindle parallel to the blade and set at zero. Clamp the handle of the square so that the standard rod (or inside mike) just fits between it and the end of the micrometer thimble.

Substitute the work to be measured and adjust the micrometer against it backwards, as shown above. Subtracting the reading from the length of the standard rod will give you the length of the workpiece.—*H. J. Gerber, Stillwater, Okla.*

Double Setscrew Stays Tight. To lock a setscrew against shock or torsion, double it up as shown at right. Tighten the first setscrew against the shaft, tool or other inside member. Then lock the second one against it, and both of them will stay put.—*Frank LaSaracina, New York.*





Spring-Grinding Dodge. Compression springs should be ground square at both ends to seat well and work properly. To grind them by hand is difficult, but a holder makes it easy. Use a short length of tubing in which the spring fits just too snugly to turn, and plug the end as shown at *A*. For small springs, drill a rod to a depth that lets the spring project ¼″ as at *B*.

A V block clamped at 90° to the face of the grinding wheel makes a good support. Slide the holder along the groove. Use a light feed to avoid overheating and drawing the temper of the spring.

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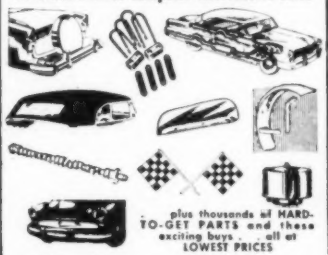

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You Can Get Better TV Pictures

[Continued from page 206]

areas. Both are all right so long as they don't cause compression of either blacks or whites.

The contrast, remember, adjusts the range of tones between black and white. If you turn it up too high, you have a picture that's made up of all whites and all blacks with no gray tones in between. Many people watch this kind of picture thinking that it looks sharp, but it really isn't. Too much contrast is the biggest pitfall to avoid.

Fine tuning. Bob was fiddling with the fine-tuning control. "This is the one I'd like to know about. Never did really understand it."

"It seems like a peculiar control," Jim admitted. "On some sets, you'll find it marked 'balance control,' and this is actually a better name for it. What it does is let you find the best compromise or balance between poor definition—a blurring of small details—and overshoot."

"Overshoot?" I said. "That's something that photographers don't run into. Just what is it?"

"Overshoot means that as the scanning spot moves across your screen, a change from bright to dark goes to too dark, and a change from dark to bright goes to too bright. The spot literally overshoots its mark."

"How can you recognize it?" asked Bob.

"Well, when your favorite charmer comes on wearing a shining halo and she isn't supposed to be an angel, then you know that you've got overshoot. Try it yourself."

Bob turned the tuning knob one way and the objects became blurred. Then he turned it the other way and suddenly exclaimed, "I've seen this before. The right-hand edges of dark objects are outlined in white, and the light objects are outlined in black."

Jim pointed to the screen. "And there's another form of the same thing. See those white hollows around Lucy's eyes? That's overshoot, too."

Tuning vs. viewing. "I've noticed," said Bob, "that the picture doesn't look the same when you tune it up close as it does when you step back a few feet to view it."

"Yes, that's why the fine tuning is a bit tricky. You have to set it so that you can just see the overshoot start to appear when you're close to the screen. Then when you move back, the overshoot will disappear, and the picture will look sharper than if you had adjusted it for no overshoot at all."

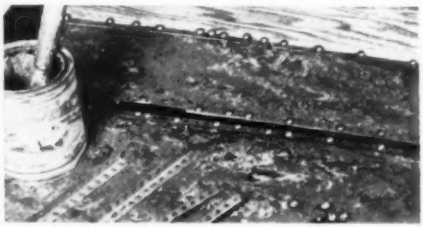
Controls interact. Suddenly Bob broke in: "Hey, when I adjust the fine tuning, it throws the contrast off."

Bob was right. Jim explained that all TV controls interact, especially the fine tuning, brightness and contrast. You may need to make occasional readjustments for this and other reasons, too. Your set will drift as it warms up and as power-line voltages fluctuate. Or the black and white levels may vary as programs change or when a commercial comes on.

Bob was bending over his controls again as I headed for the door. Last I saw, Jim was starting on his third piece of pie and Bob was beaming: "Boy, what a picture!" This time he really had something to beam about. END

Setting a Flat Linoleum Seam

USING perforated steel strips from a child's construction set, I did a perfect job of piecing worn linoleum. After cementing the patch in place, I drove round-head upholstery tacks through the holes to hold the edges down until the adhesive set, and then pried off the strips, leaving no tack-head marks.—*Bob Blatt, Larchmont, N.Y.*



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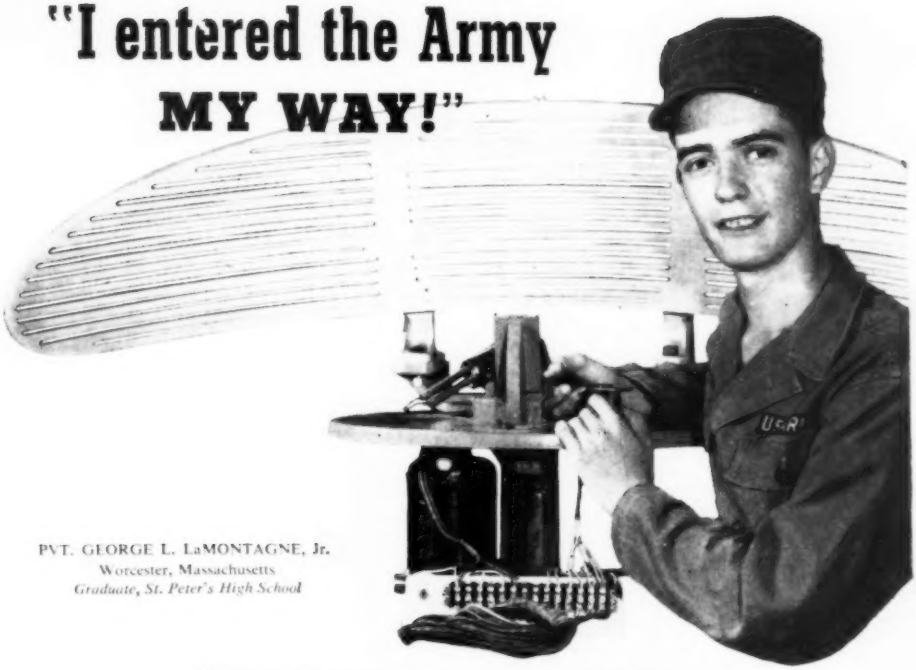

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Gus Follows a Cold Clue

[Continued from page 168]

to make the depot, and the train was usually on time. That gave him just 45 minutes to get this crate running.

GUS now fell back, as he always did, on basic mechanical facts. If you had gas in a cylinder under compression and delivered a hot, properly timed spark to it, you got an explosion. If you didn't get an explosion, one or more of these conditions was not present.

He had a hot spark, properly timed, Gus noted, but did he have gas? He pulled the air cleaner and checked the choke butterfly for proper operation. He peered down the carburetor throat as he worked the throttle, to make sure that the accelerating pump system was delivering the rich mixture required for a cold-motor start. So he had gas—but was it under compression? Maybe this bus had stripped its timing gear. Swiftly Gus again pulled the plugs, got out his compression gauge and made a compression test. It was good on all cylinders.

With the parts replaced, Miller again failed to start the car.

Now Gus was really stumped. He couldn't think of what to check next. He had gas under compression, with a hot, properly timed spark. Or had he? Since he hadn't got an explosion, one of these factors must be fouled up. Which one was missing?

"I just can't understand it," Miller said, peering anxiously over Gus's shoulder. "I went out to the barn—you know, I keep the car in my dairy barn—and stepped on the starter. Off she went, first clatter. Now she won't start."

Gus mentally pictured the barn where Miller garaged the car. It was almost as warm in there as in his house, with the heat from the bodies of the cows.

ONCE again Gus pulled the distributor cap, snapped the ignition points as he held the high-tension wire from the coil near the block. He watched with a critical eye as the spark flame jumped. There was something wrong here. If only he had a coil tester with him, he thought, or a spare coil. But who would expect to need those on a welding job? Then an idea struck him. He did have a spare coil—the one on his pickup.

Swiftly Gus moved to take the coil from his pickup motor and install it on the Chevvy. It started instantly.

"On your way," Gus said to Miller. "And tell that new son of yours hello from Gus Wilson."

"But how'll you get your truck into town?" Miller sputtered. "If my coil won't start my car, it won't start yours."

"I think it will," Gus said, grinning.

GUS installed Miller's coil on his pickup and drove in to town to the Model Garage, where he put Miller's coil on his coil tester.

"What had me whipped out there," he told his helper, Stan Hicks, "was the hot, strong spark this coil seemed to throw out. But my tester proves that it has a turn or so, maybe more, of primary winding shorted out. This won't markedly affect the peak voltage output of a coil. The distance its spark will jump, and the color, will be the same. But the spark won't last as long, since shorted windings have a dampening effect. Such a coil would be likely to start Miller's car in his warm barn, or the hot motor of my pickup, but wouldn't be able to start a stone-cold motor, like Miller's after he spent a couple hours working on that tire."

"I'll bet," Stan chuckled, "that Miller thinks you're still out there in the snow with your truck."

"I don't think he's worrying about that," Gus told him, "because by now he's driving home in a cloud with his son . . . You know, Stan, that wife of his sure is a beautiful woman."

"Beautiful!" Stan Hicks howled. "Why, she's as homely as a hedge fence."

"You haven't seen her lately, have you?" Gus said softly, as he charged his pipe and began to clean up his tools. END

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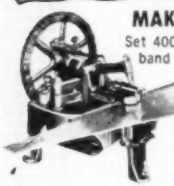

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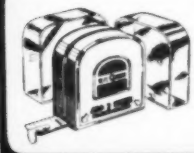

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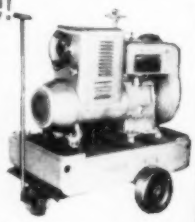

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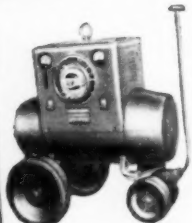

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How to Choose a Geiger Counter

[Continued from page 213]

slightly and with a gentle pulse, while others gallop erratically all over the scale. Look for a steady needle, to get fast, accurate readings.

You don't have to judge a counter's sensitivity solely by its maker's enthusiastic claims. You can test it yourself with nothing more than a luminous-dial watch, which is radioactive, and a steel tape. Or you can use actual uranium ore, of which most prospecting equipment houses have samples for sale. Four different *calibrated* samples can be obtained for $2.50 from the New Brunswick Laboratory, U. S. Atomic Energy Commission, P. O. Box 150, New Brunswick, N.J.

Using the same watch or ore sample each time that you test a counter, simply measure the distance at which it unmistakably registers the radiation. Naturally, a counter that picks up the sample at four feet is more sensitive than one that must be six inches closer before it can detect it.

What time-constant? It takes a lot of costly sensitivity to provide both short time-constants and a non-galloping needle. Shop for an instrument with the steadiest needle you can get and a time-constant only as short as you need—three or five seconds for prospecting on foot, two seconds for carborne work, no more than one-half second for airborne prospecting.

Operating cost. Before deciding on a counter, find out how long its batteries last, and what they cost to replace. With the more expensive instruments, another item can run into money—replacement of Geiger tubes, scintillation crystals, photomultiplier tubes.

Judging quality. Though you may be no electronics expert, there are pretty reliable ways you can size up the handiwork of a counter's maker. Have the chassis taken out of its case—this is quick and easy—and take a long careful look at its workmanship. Sometimes a fancy futuristic case may conceal strag-

[Continued on page 250]

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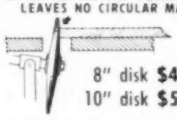

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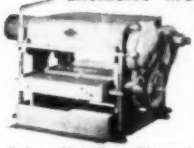

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How to Choose a Geiger Counter

[Continued from page 248]

gly wires, half-soldered connections, and tubes poorly protected against vibration and impact. A plain container may house fine circuitry. Buy performance and quality; a pretty package won't find uranium for you.

If you're buying a scintillation counter, remember that you're paying for crystal *volume*, which largely determines sensitivity. Makers' figures call for a word of caution. Formerly all scintillators had cylindrical crystals, and so you could be sure a "1"-by-1" crystal" was one inch in diameter and one inch long. In recent months, however, some counters have come on the market with rectangular crystals, usually advertised without giving their thickness. To illustrate how misleading this can be, a *cylindrical* 1"-by-1" crystal has a volume of .785 cu. in.; but a *rectangular* 1"-by-1" crystal, say ½" thick, has a volume of only .500 cu. in. and therefore it cannot "see" as much radiation.

So make sure of all the crystal's dimensions, especially if a scintillator bears a "bargain" price tag. END

Uranium That Doesn't Bulge Solves Vexing Pile Problem

By finding how to keep uranium metal from swelling, Atomic Energy Commission scientists have brought one atomic-pile headache to an end.

Fuel for nuclear reactors commonly consists of uranium "slugs" or cylinders sealed in aluminum cans. Under intense radiation or wide temperature changes, the uranium has been liable to swell. Like an old battery cell left overlong in a flashlight case, but with more disastrous consequences, the canned slug may then bulge and jam a fueling tube —or spring a leak and loose dangerously radioactive fission products.

By rolling uranium metal for slugs at elevated temperature, it can be cured of this tendency to swell, Argonne National Laboratory metallurgists report. Non-swelling castings can also be made, by using an alloy of uranium with zirconium or other metals.

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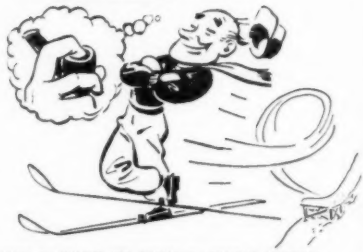
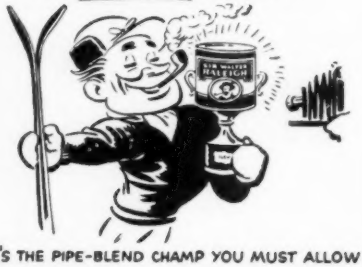


AND IT PACKS SO NEAT IT RATES A BOW

IT SMOKES SWEET



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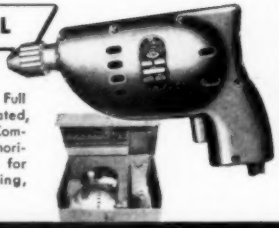

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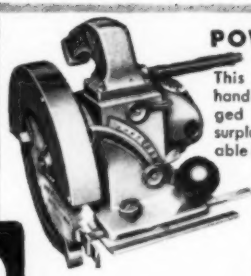

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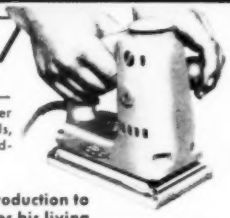

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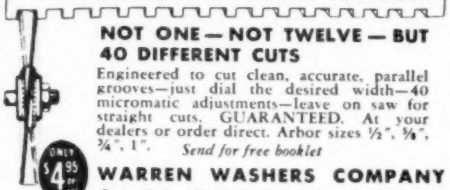

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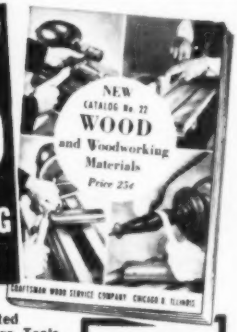

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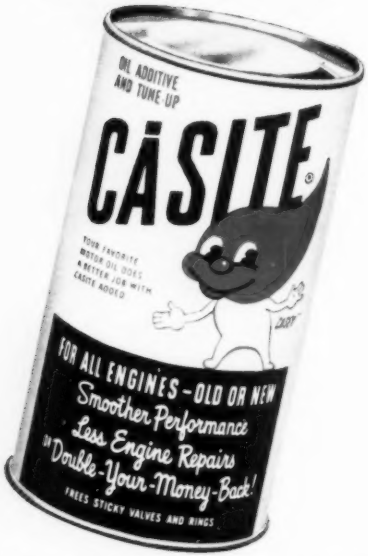

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He Puts the Noise in New Year's

[Continued from page 135]

to 16 inches. They make different sounds according to length. Not only that, but identical-appearing horns make different sounds.

"If every mouthpiece makes the same sound," he explains, "the party falls flat. They have to be different. Like this." He blows. "*Whuuhhmmpff*," says the horn. He blows another just like it. "*Waannhhh*," is the result. "Noise," he sighs, "is always a problem to us. Unless we're very cautious, every mouthpiece has the same sound."

Kazoo with a rattle. Another 1956 special is the Humdinger, a perfected version of the kazoo, which, if you remember, you used to hum into. "You get out of this one," says Hoeflich, "everything that you put into it. More, even. It amplifies your hum. What you put in comes out, only a little louder, and with a rattle. Here at the factory we call it a paper Gravel Gertie."

There are, Hoeflich tells you, two more super-specials that he's betting on:

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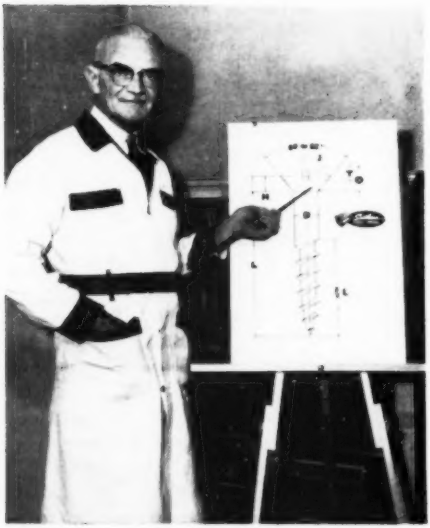
• Blowouts. These are the curled-up paper tubes that stretch way out when you blow into them. "Our '56 blowouts," says Hoeflich "are longer than any others and they blow easier than any ever made before." They also have two-piece whistles for a two-note effect.

Patented insult. Hoeflich's special pride among blowouts is the Nose Thumber, on which he has a patent. The Nose Thumber is a blowout that stretches out 27 inches to tickle the nose of the person across the table from you. (Formerly, the longest blowouts were 18 inches.) Fastened to it is a large cardboard hand that stands upright so that, when you blow, you also thumb your nose at that party across the table.

[Continued on page 254]



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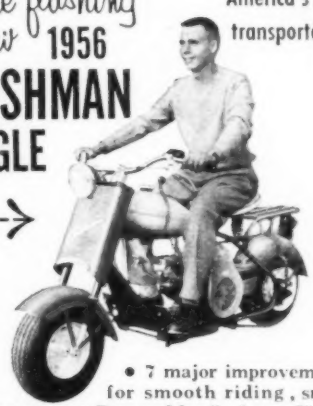

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- Saves time and money.
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46-page
"CARBURETOR HANDBOOK"
GUMOUT DIVISION
Pennsylvania Refining Co.
2670 Lisbon Road
Cleveland 4, Ohio

He Puts the Noise in New Year's

[Continued from page 252]

When Hoeflich first applied for his Nose Thumber patent, he was turned down. There was a law, the Government explained, against patenting any object that would "incite to riot." The late Mayor Fiorello H. La Guardia of New York City (including Brooklyn) came to his rescue. A mayor who liked to encourage business in his city, he convinced Washington that the Nose Thumber was not so dangerous as first believed.

Mad hatter. Victor Hoeflich designs more hats than Lilly Daché and Stetson put together. This year's fashion trends:

- Luminescent hats. Hoeflich feels that his hats should do as much for a girl in the dark as in the light. These glow. They are the only party hats that do. Like Lilly Daché's numbers, these come high: 50 cents each.
- Mae West hats. These have curved, wide brims, and look the way you think they should.
- Cowboy hats. These are a Hoeflich mechanical achievement. It took him years to figure out a machine that would put the necessary crease in a cardboard 10-gallon hat (cardboard doesn't stretch or contract).
- Fire chief's hats. These are red plastic, and expensive for party hats: about $1.
- Crowns. Hoeflich has a whole line of these—from tiny coronets to elaborate crowns. "Everybody," he says, "likes to be a king or queen."

Crepe coronation. There is an ironical story about his most elaborate crown: a copy of one of the British royal crowns, complete with crepe-paper ermine. King Edward VIII of Britain abdicated, and became the Duke of Windsor, without going through a coronation—never felt the weight of the real crown upon his brow. But last New Year's at El Morocco, a New York City night club, the Duke and Duchess each wore a royal crown made in Brooklyn.

Most unexpected best seller at the moment is the flowerpot hat. This consists of a cardboard flowerpot, draped

[Continued on page 256]

Plan now for a summer of boating fun!

Chart your course by the Weldwood tag when you buy or build a boat

The Weldwood tag tells you the boat is made with superior Weldwood Waterproof Plywood. That means: **Maintenance will be low, resale value high.** Weldwood helps keep your boat tight and dry for years. You need fewer haul-outs, get top return when you sell.

Weldwood's strength saves weight in your boat's construction. It can replace thicker planks or other materials.

Perfect for weekend boats that must stand up to repeated wetting and drying as they're hauled to and from the water. Weldwood Waterproof Plywood won't ever split, shrink or warp!

Less caulking, easier repairs. Big Weldwood panels cover large areas with fewer seams. And it's easy to bend them to simple curves or to work Weldwood with ordinary tools.

Guaranteed not to delaminate. The plies in Weldwood Waterproof Plywood are bonded with a special phenolic-formaldehyde adhesive that can never dissolve. This bond is unaffected by fresh or salt water.

Be sure of the materials in any boat you buy or build . . . look for the Weldwood name on boats and kits.

WELDWOOD—
The Best Known Name in Plywood

Weldwood® WATERPROOF PLYWOOD

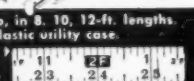
A product of **UNITED STATES PLYWOOD CORPORATION, New York 36, N. Y.**

Insist on *Evans* TAPES
"The Mathematical Genius"
At Your Hardware Store

6-ft. pocket tape only **98¢**

1700

Available, too, in 8, 10, 12-ft. lengths. Each with FREE plastic utility case. Automatically figures for you in feet and inches or total inches.

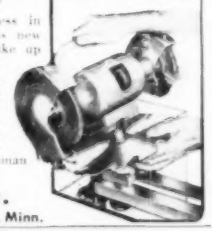


Also in 6, 8, 10, 12-ft. King-Size Tapes.

MONEY in '314'

***make $3 to $5 an hour in* SPARE TIME**

with New FOLEY GRINDER



Start your own sharpening business in your basement or garage with this new low-cost Foley "314" Grinder. Make up to $3 or $5 an hour in spare time. Sharpens circular saws, dado heads, rotary power lawn mower blades, ice skates, scissors, sharp edged tools. Also does sanding, buffing, polishing. Easy to operate—no experience needed. Send postcard today for free literature. No salesman will call—we sell only by mail.

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A SAFE way to hold work under power tools! The work CAN'T slip.

Does More Jobs Easier Than Any Other Tool Made!

No. 10W, 10" $2.60

A squeeze of the hand **locks** jaws onto work with **ton**-pressure! Quickly adjusts for use as All-Purpose Wrench, Super-Pliers, Clamp, Wire Cutter. 7" and 10" cutter optional. $1.85 to $2.60 at your dealer.

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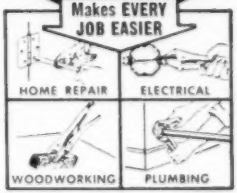
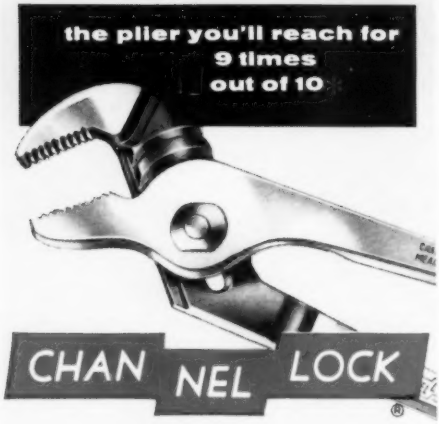


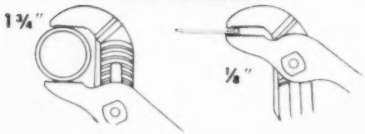
Made By PETERSEN MFG. CO., Dept. P-1, DeWitt, Nebr.



No. 420

*** because no other plier does so many jobs so well**

GRIPS LIKE A PIPE WRENCH



Mechanics tell us that our Channellock No. 420 is the handiest plier of them all . . . the plier they reach for more often than any other. They like its all 'round usefulness . . . its pipe-wrench grip . . . its big jaw-opening . . . its streamlined design for hard-to-get-at jobs. And *you'll* like Channellock for the same reasons. Ask your hardware man for a Channellock 420.

BE SURE IT'S A GENUINE CHANNELLOCK

CHAMPION DEARMENT TOOL Co. MEADVILLE, PA.

He Puts the Noise in New Year's

[*Continued from page 254*]

in leis, that Hoeflich at first put on the market as a party-table centerpiece. Nobody bought it. He turned it over and put it on the head of one of his mannequins. Now it is displayed that way across the country. And now it sells.

Back in 1949, Hoeflich put out a sun helmet with a small radio and earphone inside it. He ran a single ad (in POPULAR SCIENCE MONTHLY). "We still get orders for that hat," he says, although it has long since gone out of production.

Like most of us, Hoeflich is a man whose childhood ambitions were frustrated. "As a boy," he says, "I wanted to go to China as a metallurgical engineer. But if I could do it all over again, I don't think I'd do it much different. I'm a pretty happy guy."

> ***The best thing to do with a red-hot idea is build a fire under it.***
> —THE SIDEWALK SUPERINTENDENT

He is happy partly because he thinks he is helping to improve parties. "They are more uninhibited," he says. "My noisemakers help produce spontaneity."

Green glow the skeletons. He is happy, too, because of the quality he is getting into his products. There is, for example, his latest skeleton—a cardboard affair, with moving arms and legs, mainly for use at Halloween. Its special virtue is an eerie, greenish glow around the bones. "They're not plain black-and-white, like the competition," Hoeflich tells you.

But like any man who is enthusiastic about his work, he keeps happy most of all because there remains so much work to do. Though one man on one of his machines can today make 150,000 crepe-paper hats in one working day, and can supply the nation's needs in a few weeks, he thinks his machinery can stand a lot of improvement. So, he says, can his noisemakers. "I don't think we've got as raucous yet as we can," he explains. "We can do better." END

Now — for the first time —

Instant Change-over

with the right combination of the 3 most-used woodworking machines

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NO BELTS TO CHANGE

NO PARTS TO REMOVE

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A tool with a touch of tomorrow

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complete with ½ hp. totally enclosed, dust-proof motor that runs everything (less saw guard and table extension)

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New surplus. 4" and 6" stroke, 1 3/8" bore, 3/8" shaft. Double acting. Built in by pass and pressure relief valves. Ball bearing clevis mount both ends, and flat surface mount. 4"—$5.00. 6"—$6.00. Cash with order. Shipped prepaid.

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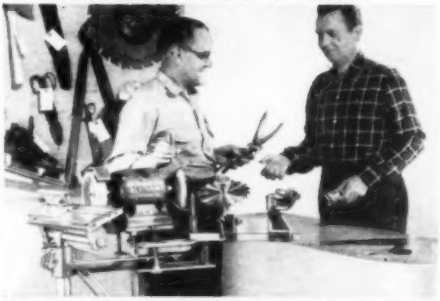

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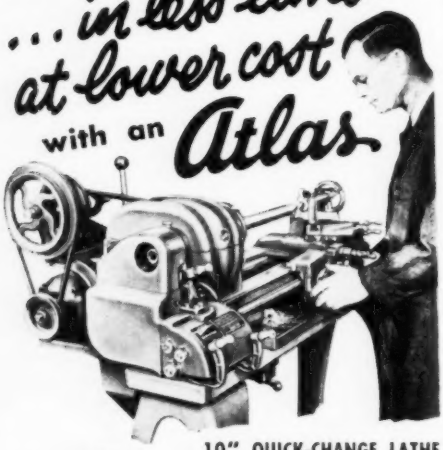

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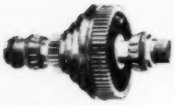
For experimental, development and hobby work . . . or small parts production, ATLAS Precision Lathes give you many more important features that increase accuracy, speed production and cut costs than any other lathes in the lower price field!

They're the only low-cost 10" and 6" lathes to give you the precision and dependable service of Timken Tapered Roller Bearings! The ATLAS 10" Quick-Change Lathe (illustrated above) with instant selection of 54 threads or feeds, instantly reversible power cross and longitudinal feeds, 16 spindle speeds, V-Belt drive, massive precision ground bed, 5 7/8" swing over carriage and 4 to 240 threading range assure you for greater ease and speed of operation, and a much wider work range than any other lathe at or near its low price!

A feature by feature comparison will be a revelation to you! Before you buy, see your nearest ATLAS Dealer . . . use coupon below for latest catalog.



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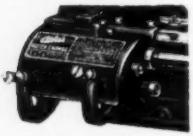

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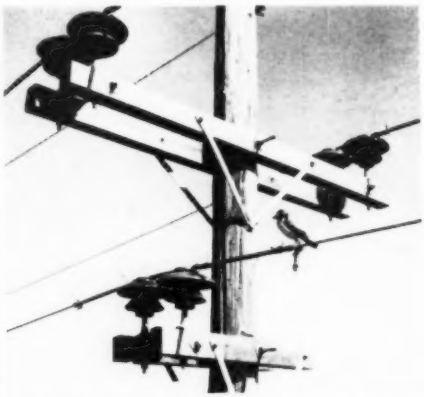
Town Crier Gets New Voice

This bike-mounted public-address amplifier gave aging Otto Gross a new lease on his job as town crier of Moerfelden, Germany. The newspaperless mountain village depends on its crier for information, but Gross's voice had been growing too weak to be heard above street noises.



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ALL ITEMS Unconditionally GUARANTEED!

RUGGED!! **20 TON** MASSIVE!! CAPACITY

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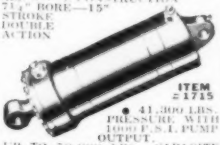

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- DOUBLE ACTION

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- UP TO 70,000 LBS. CAPACITY ON INTERMITTENT SERVICE.
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ITEM #126 — Four-way open center control valve, with built-in adjustable relief valve factory set at 1000 P.S.I. Spring loaded neutral position. For use with one double acting cylinder. In neutral position cylinder is locked and pump unloaded. Can be used as single unit or mounted in series. Has ¾" pipe thread inlet and outlet. ½" pipe thread cylinder ports. Finger grip handle. Ship. wt. 10½ lbs.

AN OUTSTANDING BUY!

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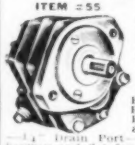

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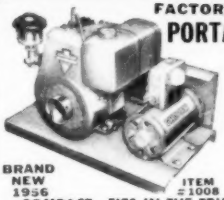

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1000 WATTS OUTPUT, continuous duty. 115 Volts A.C. 60 cycles, 9 amps. Powered by husky, easy starting Clinton engine. Engine and generator operate at 3600 R.P.M. for maximum efficiency at minimum weight. Both units are mounted on steel base, with heavy sheet metal belt guard. Generator is self regulating, and is equipped with outlet box containing fuse and 2 A.C. convenience receptacles. Cost only 5c an hour to operate. Dimensions: Length 20½", Width 12", Height 16". Shipping wt. 100 lbs. F.O.B. Chicago..... **149.50**

700 WATT—GENERATOR SET—same as above, slightly smaller—with Briggs-Stratton Engine—Model 708—F.O.B. Chicago..... **129.50**

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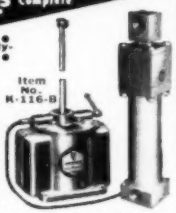

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1—Brand new Blackhawk Model P-151—Hydraulic hand pump with built-in oil tank and release valve. Rated from 1200 P.S.I.—to 8400 P.S.I. 20" handle. Dimensions 8"x6"x6". **Item #82** **22.50**

1—6 Ft. length double wire braid rubber covered hydraulic hose—tested to 20,000 lbs.! **Item #27B4** **3.95**

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2 qts. non-foaming hydraulic fluid **1.00**

All necessary hydraulic fittings.
Total ship. wt.—40 lbs.

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Brand New—U. S. Navy Cost $146.00

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For:— ● Water Pumping ● Sprinkling ● Insecticide Spraying ● Sump Pump ● Fuel Transfer—Rated Speed—500 to 2000 R.P.M.—Perfect for P.T.O. Direct or Belt Drive. Output—63 Gal. Per Min., 150 P.S.I.—use ½ to 6 H.P. 1¼" Pipe Thread Ports. 2 Grease Cups included. 1" solid Bronze Shaft—Shipping Wt. 38 Lbs. Save 118.50 F.O.B. Chicago..... **27.50**

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- For electric wheel chairs (Pop. Mech. design—Mar.-'53).
- For electric golf carts.
- For self-propelled scooters, children's midget cars.

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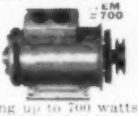
A. C. GENERATORS



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Ideal for powering electric tools, oil burner, refrigerator, lights, or other appliances requiring up to 700 watts of power. **700 WATTS,** 115 Volts, 60 cycles A.C. 3600 R.P.M. Compact, self-regulating generator with V Belt pulley and double outlet receptacle. Rotation counter-clockwise. May be driven by tractor or auxiliary gasoline engine. Requires 2 HP minimum. Dimensions: 10" long x 8" high x 6" wide. Shipping wt. 27 lbs.
F.O.B. Chicago..... **59.50**

Model 1010, 1000 WATTS
Same as above. **79.50**
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Use for small dryers, ventilators, drafts, heat boosters.

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Squirrel cage blower Mfg. by WESTINGHOUSE. Intake 1½" Dia., outlet 1½" X ⅞". Rated 6700 R.P.M. 115 Volts A.C. 400 cycles. May be operated on 60 cycle current at reduced voltage. Overall size 4"X3½"X4". Price Postpaid **$5.95**

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200-250 Amp. 24 Volt DC. 4500 RPM. Makes dandy Arc Welder. Cost $396. Used like NEW—SPECIAL $12.88. Gov't. Overhauled $19.80—NEW $24.75. FOB York. Diagram Free! GUARANTEED! Cat.—1000's BIG BARGAINS FREE!
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Kitty Kimsul says:

"Here's the easiest insulation of all to cut, measure and install!"

• KIMSUL Insulation is designed to cut winter fuel bills up to 33%—to keep your house up to 20° cooler in summer.

• And KIMSUL is clean—free of irritating dust and slivers.

• So light and compact even a woman can carry a 200 ft. roll—or take home enough in the car to insulate an entire attic.

At your Kimsul lumber dealer's—this denim cobbler's apron. Regular $2.50 value—only 89¢

Perfect for hobby work, gardening, barbecuing. Has three large pockets, adjustable waist and neck bands. Only at your KIMSUL lumber dealer's and only for a limited time.

KIMSUL INSULATION — A PRODUCT OF Kimberly-Clark

Kimberly-Clark Corporation • Neenah, Wisconsin

Secrets of the South Pole

[*Continued from page 105*]

30 tons of food, fuel and gear per man—against seven tons shipped overseas for each soldier in World War II:

Food. Scott's little band of men on their way out from the Pole died, some explorers think, not from the minus-75-degree cold, but because the party starved. The men did not have enough to eat to do the work that they had to do to survive. This year, food is supplied on the principle that in the Antarctic you need twice as much to have half the energy you have at home.

There will be lots of meat—all boned, with roasts tied ready for the oven, before the expedition left the U.S. This meat is mainly beef (for energy, and because beef keeps well). And there will be lots of candy and desserts (for energy and a feeling of luxury).

Clothing. In the past it has not been warm enough, or, if it was, it scratched. This year it's based on the principle, learned the hard way by previous expeditions, that it's best to wear several layers of lightweight material. Each man will have two suits, one heavy, one light; at the Antarctic's coldest—possibly minus 100 at the Pole—he can wear the heavy over the light. Beneath, each man will wear long, waffle-knit cotton underwear. It's warmer than old-fashioned woolen underwear and less itchy.

Hoods for outdoors will be lined with wolverine fur, found not to hold moisture when the breath or damp air falls on it. Gloves will be worn like clothes—one layer over another. A man may have three sets of gloves on his hands at once. Footwear: Korean boots.

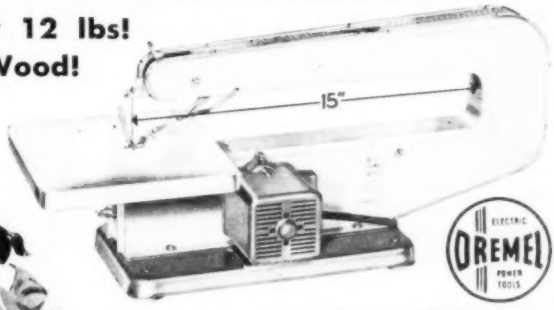
Shelter. The U.S. will construct 70 prefab buildings at its four main camps—six at the Pole itself. The buildings will have plastic domes so that men won't have to go outdoors to watch Rawinsonde balloons. They will have hot and cold running water, and indoor plumbing.

Transportation. This year's biggest snow tractors are 35-ton D-8s that look like freight engines and pull sled trains.

[*Continued on page 262*]

The JIG-SAW Designed for EVERY MEMBER of the FAMILY!

Portable! Weighs Only 12 lbs! Powerful! Cuts 1 3/4" Wood!



Model 8 (8" throat) **$23.50**
Model 15 (15" throat) **$29.95**

HERE'S a practical, fun-to-use hobby and do-it-yourself tool the whole family will love! The new DREMEL easily out-performs heavy cast-iron jig saws costing many dollars more—rips through 1¾" wood, light metal, plastics! It's so easy to use even a novice becomes an expert in no time. You'll make furniture, cabinets, toys. You'll save on home repairs. Best of all, you'll unite the family around an exciting woodworking hobby. Foolproof BLADE GUARD makes it safe for women and children. And what a performer! Just wait till you feel the surging power of its ROTARY MOTOR! For an eye-popping experience, try the new DREMEL in your own home—soon!
SEE YOUR DEALER. If he cannot supply, order direct on 5-day trial, money-back guarantee. Remit in full for postpaid shipment. Or send $2 now, pay postman balance plus COD fee.

WRITE FOR FREE CATALOG!

DREMEL Mfg. Co., Dept. 126-A, Racine, Wisconsin

DEPEND ON DREMEL FOR NEW IDEAS IN POWER TOOLS!

NEW, IMPROVED CALCULATOR FOR WOODWORKERS only 25c

Instantly gives information on lumber, nails, concrete mixes, painting materials, etc. Convenient, simple to read. Just set dial for nail specifications, to convert linear to board feet, find bit sizes for screws, compare characteristics of woods. 6" diameter heavily varnished cardboard. Send 25c, no stamps, please to Greenlee Tool Co., 2121, Columbia Avenue, Rockford, Illinois.

NOW—SHOPSMITH
for as little as **$3 per week**

Start *enjoying* SHOPSMITH now for only $29 down, $3 weekly. Start *saving* now! Savings on projects and home repairs can more than equal weekly payments. See your hardware dealer or Montgomery Ward store. Write for 2 big, free, illustrated books.

SHOPSMITH, Dept. 318-A, Menlo Park, Cal., Waynedale, Ft. Wayne, Ind

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NOW—THE QUICK-WAY TO SHARPEN ALL CIRCULAR SAWS

NEW

Model PG-12 Complete No extras to buy. **$16.50** Postage Paid

Model PG-12 sharpens, joints, gums, and retooths all cross cut, rip, combination, miter, and planer blades up to 12" in diameter. Two precision index plates give versatile, accurate sharpening. Guarantees precise spacing of teeth. New safety rest prevents tilting and gouging of blade. Save time and money. Special $3.00 grinding wheel also included for use on your own power table. Fits regular or radial swing tables.

Order today. Send check, cash, or money order. We pay postage.

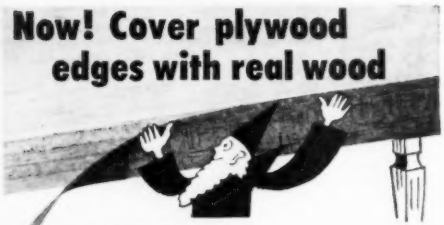
QUICK-WAY SAW CO.
100 Hornby Drive, Painted Post, N. Y.

FOR WORK... OR PLAY

Anvil Brand utility clothes are so comfortable and smart you'll like their all-purposeness. Heavy duty outfits in all styles and hardy, washable fabrics. Sportswear, too, for men and boys. See your retailer's display of Anvilwear. Learn how reasonably you can buy more clothes comfort and durability.

ANVIL BRAND FACTORIES HIGH POINT, N. C.

Now! Cover plywood edges with real wood



New Flexible

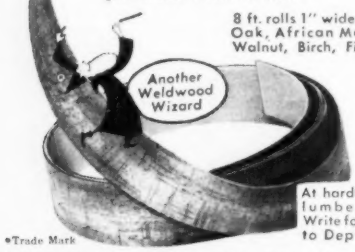
Weldwood® Wood-Trim®

Avoid unsightly edges in building any plywood project—tables, desks, cabinets, etc. Give them a "pro" finish with Weldwood Wood-Trim. So flexible you can beautify any edge—straight, curved, angled. In handy rolls, Wood-Trim is a cinch to apply. No clamps, nails, hot iron, etc. Just use Weldwood Contact Cement or Presto-Set® Glue.

Countless Decorating Uses!

Trim lamp shades with Wood-Trim! Decorate picture frames! Smarten coffee tables, clocks, waste baskets, etc. There's no end to the wonderful ways you can put Wood-Trim to work.

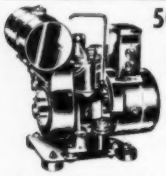
8 ft. rolls 1" wide, 79¢ each. Oak, African Mahogany, Walnut, Birch, Fir, Korina.



At hardware, paint, lumber dealers. Write for free leaflet to Dept. PS1-6WT.

®Trade Mark

UNITED STATES PLYWOOD CORP., Box 525, New York 46



500-WATT POWER PLANT

NEW Gov. Release! Original Gov. Cost $330.00

One Emergency Use and it's paid for! SPECIAL ONLY $79.50 PREPAID

FULLY GUARANTEED

Briggs & Stratton Gas Engine Compound-Wound Generator

PORTABLE! Worth its weight in gold in event of power line interruptions—and for many daily farm, home and construction jobs. Priced at less than cost of gas engine alone! OPERATES: Light bulbs up to 500 watts; incubator and brooder heat lamps (keeps chicks alive in power failures); ½" electric drills; 6" blade power band saws (where lines are expensive to run in); food mixers; vacuum cleaners; floor polishers; AC-DC radios; electric hedge trimmers; shallow well pumps; many more machines.

Compound wound generator has max. output of 500 watts, 115 volts DC (although rated by army at 250 Watts for severe climatic conditions). Powered by Briggs & Stratton 1½ HP, 4-cycle 2700 RPM, easy-to-start engine that operates 3 HOURS ON 1½ GAL. OF GAS. Automatic governor maintains full voltage regardless of load. Standard duplex outlet receptacle with built-in filter and condenser eliminates static in radio reception. Cushion mounted for vibrationless operation. Instruction manual included.

Included CARRYING CASE with **FREE** Handles and "Latch-on" locks

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FREE Catalog of Compressors, Motors and Welders

ROBERTS ELECTRIC CO., Dept. PS-357, 849 W. Grand, Chicago 22, Ill.

Secrets of the South Pole

[*Continued from page 260*]

The D-8s have heated cabs, cushioned seats, radio communication and 54-inch-wide treads so as not to sink into the snow. There are smaller tractors, too.

This year's biggest sleds have a capacity of 20 tons, are shipped in three sections and ride on skis. There are smaller sleds, down to one ton in capacity.

But there is terrain—mountains and crevasses—that tractors can't cross. There is weather—blizzard, blow and the white-out—where planes and helicopters can't fly. For such occasions the U.S. is relying on Amundsen's method: dogs. The U.S. started with three teams, of nine 75-pound Huskies each, both male and female. They will mate and the number will increase, Navy men hope, as the next several years go by.

Prime movers. Bulldozers with chains on their tires will hack out airfields. (When the frigid cold cracks their steel blades—as it will—new blades will be flown in or parachuted.) Rough-terrain fork-lifts will reach down into sled bodies and lift out cargoes.

Fuel. This makes up two-thirds of the provisions that the U.S. is carrying to the Antarctic. A tanker full of aviation gas will be frozen into the ice along shore. So will a tanker of gas for ground equipment. The furnaces heating the buildings will burn diesel oil.

Color. Almost everything in the Antarctic is white, especially during the winter. On many days, both sea and air are white with snow and ice particles, floating or suspended. In this white-out, the ground looks the same as the sky to a pilot, and he'll bump the runway thinking he's way above it. On the ground, a man walking can't even see where to step.

Tents and mechanized equipment, therefore, are painted, or carry patches of, international orange, a shade selected for high visibility. Those windproof clothes are red, blue or international orange. For airborne or sled parties, the U.S. also provides black suits. You put them on if you are in trouble and need

[*Continued on page 264*]

MODERN

LAWN MOWER SHARPENER

COMPARE BEFORE YOU BUY

Write for free booklet 11R

Start your own business—increase your income

Sharpens any mower in ten to twenty minutes. Handles complete assembly of all reel types including 36 in. power mowers. Handle, wheels, roller, and engine are not removed.

Oil remains in engine while sharpening. Bed knife sharpened in same centers — no attachments needed.

$26300 F.O.B. PASADENA

MODERN MFG. CO.
160 N. FAIR OAKS, PASADENA, CALIF.

COMPLETE SOLDERING KIT only $7.95

Includes: Weller Soldering Gun, over 100 watts; supply of famous Kester Solder; Weller Soldering Aid; and Wire Brush. For hobbies and homecraft. Write for catalog.

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KNIVES • TOOLS
HANDICRAFT KITS

NO. 82
KNIFE SET
$4.20

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Prices below per 100 board feet Air Dried & Rough

WALNUT 1 inch No. 1 common	$30.00
CHERRY 1" First And Second	$35.00
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Complete with Twin Carbon Arc Torch and accessories . . . to handle all metal-craft work.

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Mammoth 1956 Wholesale Tool Catalog

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The opportunity now awaits you to own and operate your own business on a part time or full time basis in the lucrative field of HARDWARE, HAND TOOLS, FANS, POWER TOOLS, MOTORS, PAINTS, etc., or BUY TOOLS FOR YOUR INDUSTRIAL OR INSTITUTIONAL USES.

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I am enclosing $1.00. Rush me your dealer's card and big Catalog Today. If I am not completely satisfied with your plan, I understand that I can return the Dealer's Card and Catalog for refund, and if I decide to order, my $1.00 will be deductible from my first order.

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QUALITY STEEL...

Good saw steel should be hard enough to hold its cutting edge and yet malleable enough to be flexible. Only saw manufacturers who operate their own mines and steel mills can give you the uniform controlled steel consistency necessary in every saw blade. Sandvik Swedish Charcoal Steel Hand Saws feature this high quality hand saw steel. This is only one of Sandvik's many exclusive advantages. Before you buy **any** hand saw, ask your dealer to show you a Sandvik.

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LIMITED SUPPLY! BRAND NEW, BALL-BEARING

SINGLE PHASE ELECTRIC MOTORS

FAMOUS BRAND! SAVE WAY OVER HALF!

Power-at Capacitor and Repulsion-Induction MOTORS with **heavy starting torques** to handle EVERY heavy-duty job. NEW, ball bearing models that mount IN ANY POSITION. 115-230 Volts, 60 cycle, single phase. Standard mounting and shaft size. **Perfect for:** refrigeration, saws, machine tools, blowers, grain elevators, woodworking tools, pumps and farm equipment. Fully guaranteed. Save dollars!

ORDER DIRECT FROM THIS AD TODAY!

¾-HP, (Reg. $49.80) 1750 RPM, Ball Bearing.....only **$29.85** fob
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MAKE UP TO $25 DAY

sharpening Discs with New Machine

Now you can quickly sharpen farm discs in a farmer's **own yard or shop.** New portable Foley Disc Sharpener jacks up harrow, rotates discs as it grinds them—takes only 1 or 2 minutes per blade. Saves farmers time and trouble—no dismantling or hauling to town—and you can make up to $25 a day. Foley equipment easily carried in car trunk.

FREE PLAN—shows how to start in spare time CASH business. No experience needed—no salesman will call on you. Write today.

C. I. FOLEY CO.
COLUMBIA HEIGHTS, MINNESOTA

Secrets of the South Pole

[*Continued from page 262*]

help. Black, very visible, in the Antarctic this year means that you are in distress.

Recreational equipment. Men cooped up near the South Pole traditionally feel irritability, despair and loneliness. Another name for all this is cabin fever.

Lt. (j.g.) John Condit, a chaplain who is wintering over, took along paraphernalia for religious services of all denominations, equipment for a glee club and orchestra, and educational courses, books, films, travel slides of places like Panama and Honolulu, and hobby kits.

In the little U.S. cities of the Antarctic, men will be paid regularly in cash, and ship's stores will sell them gum, skivvies, tobacco, Cokes, beer and all the rest. Chaplain Condit also carried a book entitled *5,000 Indoor Games for All Occasions.* This precaution, some old polar hands thought, was unnecessary. With cash on hand, they anticipated only one major indoor sport: the biggest poker game since the days of the Yukon.

Communications. A vast radio network is being set up to keep the U.S. camps in constant communication with each other, with the expeditions of all other nations, and with Army, Navy and Air Force stations in Washington, D.C., and over the globe. Four amateur radio stations on the ice—including K4USN at the South Pole—will communicate throughout Antarctic winters with the 130,000 amateur radio operators in the U.S. Object: to bring voices from the Antarctic into home towns everywhere.

Some ham sets in the U.S. can connect with telephones. This crowning touch shows how complete is U.S. equipment in the Antarctic: A man at the South Pole this time may, if he desires, ring up his home in Boise, Idaho, or Chattanooga, Tenn.—*Gardner Soule.*

Keeping Him in Suspense

"Mother, I just knocked over the ladder in the garden."

"Well, you'd better tell your father."

"He knows. He's hanging from the bedroom window."—*L & N Magazine.*

GIGANTIC SAVE-TO-70% **MAIL SALE** WAR SURPLUS EXCESS INVENTORY BANKRUPT STOCK

PORTABLE HEATER 39,000 BTU Output

- Brand new Govt. surplus. Excellent for contractors, farmers, sportsmen. Burns any fuel from 100 octane to Diesel-X.
- Preheat tractors, bulldozers, airplanes, etc. Heat bldgs, cabins, tents, brooders, etc.
- 110-v, 60-c motor driven blower. Size 18" x21"x9". Automatic safety shut-off. Light weight, portable or stationary use. Govt. cost over $190. **SALE.** Prepaid. **$49.50**

SPEED REDUCER

- Heavy duty, roller bearing unit. Handles up to 3 hp. 15-1 ratio. Precision cut worm gears. All moving parts run in oil.
- Double input shaft, 1⅜" diam. Output shaft 1¼" diam. All shafts sealed. Wt. 27 lbs. New cost over $79.50. **SALE.** Prepaid. **$29.50**

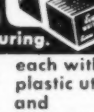
RIGHT ANGLE DRIVE

- Rugged, roller bearing, right angle drive unit has many applications. Excellent for steering control on boats, miniature cars, etc.
- All moving parts run in oil. Hardened steel gears. Input shaft ¾" diam. x 7½" long. Output shaft 1-1/16" diam. x 3" long. Gear ratio, 16 to 1. Original cost over $39.50. **SALE.** Prepaid. **$13.90**

IRRIGATION PUMP 2½" size, 16,500 gph

- Brand new Navy bronze ball bearing hi-capacity centrifugal. Wonderful small farm and truck irrigation, many industrial uses.
- Capacity to 280 gpm. Pressure to 65. Speed 2100-2700. Clockwise rotation. Complete with 6" pulley. Wt. 40 lbs. Size 10"x11"x9". Inlet 2½", outlet 2".
- Note—2 of these units driven by single engine will deliver almost 600 gpm or 33,000 gph. Natl. Adv. list $98 each. **SALE.** Prepaid. **$44.37**

CONTRACTOR-ARCHITECT LEVEL



- Excellent highly accurate professional instrument made by leading manufacturer. Ideal for setting foundations, grading, farm contouring, surveying, etc.
- Powerful erecting optical telescope, polished graduated degree scale, sensitive spirit bubble, etc.
- Furnished complete with 8½-ft. 3-sec. rod, fine tripod and polished wood carrying case. Our 4-star buy! Prepaid to you **$39.27**

SPECIAL LISTINGS

We list below some super prepaid-to-you bargains available in limited quantities only.

- **$150 G.E. Experimental Amplifier** .. **$6.97**
- **$15 Gov't. Sleeping Bag with Cover** **$5.74**
- **$3 Finest Wood 1"x16" Chisels** **$1.19**
- **$150 5-Row Weed Spray Outfits** ... **$97.65**
- **$30 Electronic Experimental Kit** ... **$4.99**
- **$15 Army First Aid Chests** **$6.95**
- **Eastman Film and Paper**—savings to 70%!

HYDRAULIC BARGAINS

- **Pump.** 1000 lbs., 12 g.p.m., 400 r.p.m. **$45.50**
- **Cylinder.** 3" bore, 24" stroke, 7000 lb. lift **$39.90**
- **Cylinder.** 2" bore, 10" stroke, 3141 lb. lift. Sale **$16.50**
- **Control Valve.** For single or double acting cylinders. Sale ... **$17.98**
- **Pressure Gauges.** 1000 lb., 1500 lb., 2000 lb. **$3.49**

HAND HYDRAULIC SYSTEM

- Build your own arbor press, wagon unloader, shop tool tester, etc. Genuine brand new Blackhawk hi-pressure hydraulic pump system. Complete unit including reservoir, check valve, etc. Will develop pressure to 8,000 lbs! Wt. 35 lbs. Gov't Cost over $100.

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6-Volt HYDRAULIC PUMP

- Complete hydraulic system. 6-v DC motor operates from truck battery. Drives 2,500 lb. per sq. in. pump. Has control valve, etc. • Use for dump trucks, snow plows, jacks, lifts, special machinery, etc. Leading make. F.O.B. Wt. 48 lbs. List $121.50. SALE **$45.50**

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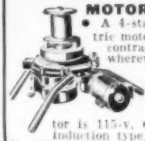
- Amazing electro magnetic switch. Complete with dial. Any circuit from 1 to 100 can be selected simply by dialing the number, uncanny response. Will work over lines up to 20 miles. Used, excellent. • Fine for intercoms. Private automatic phone systems, remote control, experimental, etc.

New Cost Over **$150.00.** Sale, **$13.75** Ppd.

SPECIAL OF THE MONTH!

MOTOR DRIVEN WINCH



- A 4-star special! Rugged electric motor-driven winch ideal for contractor, builder, farmer or wherever load lifting is necessary. • Completely weatherproof, designed for continuous outdoor use. Speeds work. Saves time and money. • Motor is 115-v, 60-c, G.E. squirrel cage induction type. Reversible, runs winch in either direction. Load capacity 1000 lbs. Drum capacity 100' of ¼" cable. Cost Govt. over $495. **SALE.** Prepaid (less cable) **$69.50**

TV-HAM ANTENNA TOWER

- Wonderful surplus buy! Excellent for TV and amateur radio antennas. 30-ft. tall. Heavy construction.
- Copper-bearing steel, hot-dip galvanized. Has ladder for climbing and servicing antenna, etc.
- Units can be combined to 150' ht. Face width 12". Will withstand 100 mph winds. Complete with guy cables, hardware for assembly, three expensive 2200-lb. anchors, etc. In 3 crates. Wt. approx. 250 lbs. Cost Govt. over $150. **SALE**, FOB our warehouse Vanceburg, Ky. **$31.95**

AIR COMPRESSORS—TANKS, Etc.

Save to 70% on air fittings, tanks, compressors, etc. See our catalog.

- **Piston Air Compressor 150 lb.** ... **$18.91**
- **Air Corp 300-lb. Pressure Tank** ... **$6.79**
- **Auto Pressure Switch for Motor** ... **$4.95**
- **Professional Paint Spray Gun** **$9.95**
- **DeLuxe Air Kit complete** **$45.49**

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- **Giant Flood Light** (cost $8000) **$48.90** F.O.B.
- **AC-DC Power Rectifier** **$15.61**
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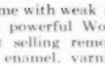
- **Gov't. Prismatic Periscopes** **$1.99**

ARMY POWER PLANTS

- Marvelous buys in new condition Govt. surplus plants and generators. We pay freight!



- 1000-w, 115-v, 60-c, **$149.50**
- 2000-w, 115-v, 60-c, **$289.50**
- 3000-w, 115-v, 60-c, **$349.50**
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50 ft.-100 ft. long

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For building and gardening measuring.

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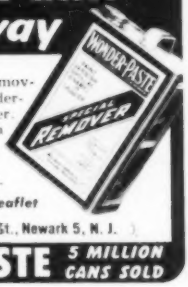

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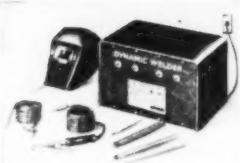

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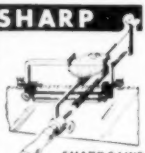
IT'S NEW! with Automatic DEPTH CONTROL ROLLERS

Automatically controls **DEPTH—ANGLE—PITCH**

Perfect bevel and angle maintained, and foolproof depth control for all Rip, Cross-cut, and Handsaws. Precision made and calibrated for instant setting at desired angle. Can be used in any vise or clamp. Complete with file, only **$6.50** ppd.



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JOINT & SHARPEN CIRCULAR SAWS

Sensational New Super Filer No. 11 joints and sharpens both **hand** and **circular** saws 6" to 10" with all teeth the correct height, depth, pitch and bevel. Easy to use—when file hits hardened steel roller, teeth are finished. Saw runs true and smooth with no side pull. Complete with special 8" file **$9.95 ppd.** "TRU-CIRCLE" saw set automatically sets teeth at 10° or more **$2.95.**

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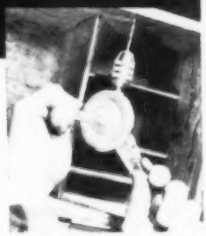
Drills Around Corners! Adjusts to Any Angle!



Your toughest drilling jobs are a cinch with P&C's new All Angle Drill. 0 to ¼" capacity chuck swings 270°. Handle moves 180° at right angles. Spring lock changes angles at flip of your thumb. Hollow handle stores drills. Buy it today.

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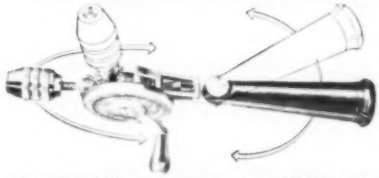

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Plastic Moon to Circle Earth

[*Continued from page 126*]

These studies, that can be made by tracking from the ground, apply to all satellites. But aside from that, each bird will probably have a "personality" all its own. So many research jobs have been suggested that no one satellite could possibly carry the necessary instruments for all of them. These include studies of solar ultraviolet and X rays, electrical currents and magnetic influences, cosmic rays, micrometeorites, and hydrogen and ion densities.

Space missions. It is logical to suppose that specific research tasks will be apportioned among the satellites. Out of the above list, one bird might do two jobs: (1) study solar ultraviolet rays to gather information that may lead to a better understanding of climate and weather; (2) investigate electrical currents flowing in and beyond the ionosphere that may have an effect on long-range communications. For the first it would use photon counters; for the second probably a very special instrument that is known as a proton precession magnetometer.

This instrument, also called a nuclear resonance magnetometer, in its satellite form would be a small plastic tank filled with plain water in which a copper coil was immersed. Connected with it would be a programmer which, when it was triggered into action by a signal from the ground, would energize and de-energize the coil alternately every second.

When the coil was energized, hydrogen nuclei in the water would line up like little magnets. When the coil was de-energized, these line-up "magnets" would change their positions, precessing, or wobbling about the direction of the earth's magnetic field. This movement of the nuclei would set up tiny electric currents in the coil, to be amplified, translated into coded signals and radio-telemetered back to earth. By interpreting these signals, and comparing them with magnetometer readings at the earth's surface, scientists could measure the

[*Continued on page 270*]

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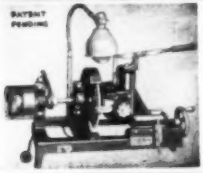

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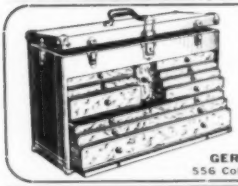

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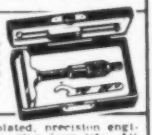

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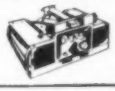

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Plastic Moon to Circle Earth

[*Continued from page 268*]

strength of the earth's magnetic field at the precise position in space of the man-made satellite.

Looking into space. These scientists on the ground will want to know at all times where their eyes in space—the bird—are looking and obtaining their information. This could be done with optical-aspect tubes that, by sending back signals of varying strength, would actually tell whether they were aimed at the sun, into black space, at the moon or the earth. Backing these would be magnetic-aspect tubes. These would measure a satellite's attitude, or aspect, in space in relation to the known direction of the magnetic field.

Standard equipment for all the satellites probably will be a data-input circuit to code all information for intelligible transmission, and a modulator to superimpose the coded data on a carrier signal that will radio it to a ground receiving station, where it is interpreted. This is radio-telemetering.

It is a good bet that these instruments and their electronic circuits will not be enclosed in the familiar little black boxes, but will be exposed, and probably attached directly to bulkheads that will also serve as internal bracing for the shell. Little black boxes weigh too much.

This, then, is what the first artificial satellite may be like—the details of its construction, its close-up appearance, its probable functions. But its true significance will be the awesome achievement of science in projecting man—man's brain—into outer space.

As an American, you will be able to look at that dim spot of light moving swiftly across the sky and say, with pride, "I know what that is. I helped to put it there." END

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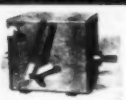

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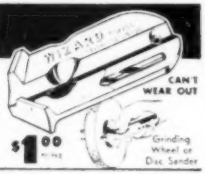

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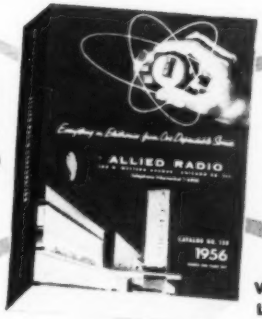

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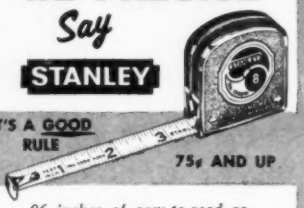

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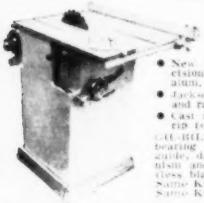

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Why Drivers Like New Little Taxis

[Continued from page 111]

are the same ones that are offered in other Chevrolets.

Ford engineers say that some fleet owners are interested in installing Ford seat belts, and like the deep-dish safety wheel and safety door locks. Besides the standard taxi package, which includes heavy-duty brakes, Ford offers such special gimmicks as an engine light, governor, power windows and an extra cooling fan. Engine, frame and battery are unchanged from regular models.

Plymouth makes special doors. Instead of the regular upholstery backed by cardboard, there is a vinyl covering over ⅛-inch tempered Masonite. Passengers kick the life out of taxi doors, smash windows when they slam doors. To correct the latter, Plymouth cabs have stronger windows. Plymouth also features a battery heat shield and special cab carb. Push-button drive is available. How taxi drivers like it is something that the industry will soon learn.

The sleek-looking Dodge is patterned after the Plymouth, for a higher price.

Taxis are the guinea pigs. Detroit is using taxis, more and more, as a proving ground. "We find out things in three months that might not be learned in two years of passenger-car use," one executive said.

Chevrolet men, in fact, learned the value of the fast-fill gas tank from their taxis; now it's standard on all Chevvies.

Kalamazoo learns, too. When Pittsburgh drivers began reporting excessive right front tire wear, the Checker company investigated.

"We found," says Ralph West, "that the drivers were using the right front wheel to hold against the curb. The parking brakes needed deeper notches for those Pittsburgh hills—ours and some other guys', too. We now cut the notches deeper and the brakes hold!" END

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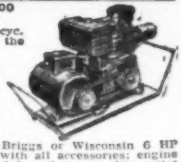

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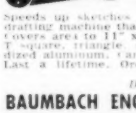

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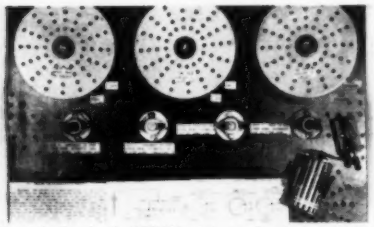

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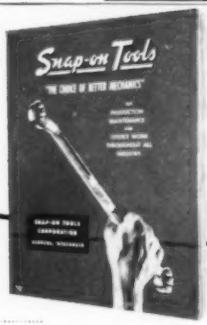

A big, fact-packed catalog full of pictures and tool information . . . yours for the asking.

- *Snap-on* tools help you handle repair jobs faster, easier, better.
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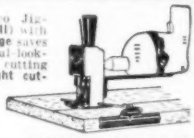
"THE CHOICE OF BETTER MECHANICS"

"ARCO JIG-SAW"

WITH EXCLUSIVE NEW CIRCLE-CUTTER & RIP GAGE!

Another "ARCO" FIRST! "Arco Jig-Saw" (guaranteed to fit any ¼" drill) with **Adjustable Circle-Cutter & Rip Gage** saves hours of work—assures professional-looking results everytime—whether cutting **circles, curved patterns, or straight cutting.** Cuts perfect circles any size up to 20" diameter; rips accurate widths any size up to 10" wide. Has same capacity and cutting speed as $55 Jig saws. Does work of **Jig, Keyhole, Coping, Rip, Crosscut, Band & Hacksaw!** Built-in "Air-Jet" blows away sawdust. Cuts intricate patterns—however large—in plywood, plastics, metals—even cuts 2x4's! Starts inside holes. Includes blade. Converts to **Table Model** with



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No. 401 "ARCO STAND" Sturdy Casting & Clamp..... $2.75

6 Extra Assorted **Blades** for wood, plastics, metals..... $1.95

SOLD AT BETTER HDWE. STORES EVERYWHERE. If not available, order direct with handy **"ARCO" coupon on opposite page** and the built "Arco-Saw" Stand & "Arco Jig-Saw" on our **UNCONDITIONAL 10-DAY MONEY BACK GUARANTEE.** Send check or M.O. (ppd.), C.O.D.'s—plus post.

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75 Mounted Wheels & Miniature Cutters. Regular $11.00 value

$4.50 Post-paid

For cutting and grinding on paid wood, metal or plastic. Includes 26 mtd. wheels and points on 3/32" shanks; 24 miniature cutters on 3/32" shanks; 25 short shank mtd. cutters. Will fit all electric drills and hand grinders.

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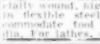
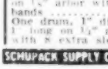


$4.95 Post-paid

Fits all electric drills & hand power tools. 35½" long. Oilite bearings. Core of specially wound, high carbon steel wire in flexible steel casing. Will accommodate tool shafts up to ¼" dia. For lathes, electric drills, etc.

2 DRUM SANDERS



With 12 Bands in Assorted Grits. 1½" dia. x 1" long on ¼" arbor with 12 bands..... $1.50 Post-paid

One drum, 1" dia. x 1" long on ¼" arbor with 8 extra sleeves $1.00 Post-paid

12 MOUNTED WHEELS and points on ¼" Shank

$2.95 for 12 $7.50 P.P.

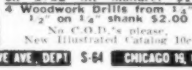
For grinding on plastic, wood, soft & hard metals. Regular Value $8.00.

18 Mounted points on 3/32" shank $2.50; 12 mtd. wheels on ¼" shank $3.60

18 Rotary Cutters P.P. $5.85

Assorted sizes cutter on ¼" or 3/32" shank. Will fit all hand grinders. Ideal for cutting wood, metal, or plastic. Brand new.

ADAPTER CHUCK



With 2 interchangeable collets, opening from 1/32" to 1/8, on 1/8" mandrel. Price each only $1.50 P.P.

Adapter Chuck. From 60 to 80 on 3/32 in. Mandrel $1.00

4 Woodwork Drills from ¼" to ½" on ¼" shank $2.00

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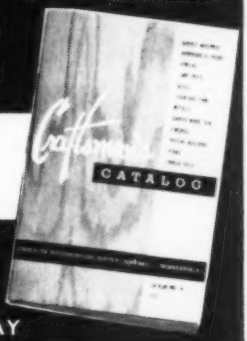

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Our Customers, we are starting our SECOND DECADE in business! In appreciation we want you to accept our gift of a Free Ball Point Pencil with each order placed from this ad.

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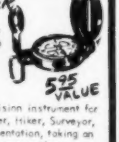
ONLY 3.95 NEW

Picks up standard broadcast stations without using batteries or electricity. Just plug in headset, antenna and ground-wires and tune in your favorite program. You'll be amazed at the STRONG, CLEAR SIGNAL. Has a 100KC tuning range. Comes complete with Receiver, Antenna and Ground wires PLUS a 2000 ohm Headset. A GENUINE CRYSTAL RADIO SET.

RS38A MICROPHONE

Carbon type with push-to-talk button. Ideal for use where background noise is high. Can be operated with 1½V drycell. Comes 6 ft., 3 conductor, shielded cable & plug. 2.49

ARMY OFFICER LENSATIC COMPASS



3.95 5.95 VALUE

An all-purpose precision instrument for the Boy Scout, Hunter, Hiker, Surveyor, etc. Used for map orientation, taking an azimuth reading or as a guide on unfamiliar terrain. Has a 360° rotating bezel ring marked in 3 degree notches for fine computation. Cover has built-in "peep" sight and hairline guide for sighting on distant objects or landmarks.

STEEL FRAME ARMY SKI TROOP RUCKSACK

12.95 VALUE 8.95

NEW! For Hunter, Hiker, Boy Scout, etc. Made of extra strong Army Duck, has one large main compartment and three smaller pockets. All have covers. The entire Pac is mounted on a lightweight tubular steel frame. Has adjustable web-type shoulder straps and bindings.

FOLDING SHOVEL

Carry in car for emergency shovel. Has 20" hardwood handle. Blade folds to form shovel or pick. Ideal for Boy Scout, Gardener, Camper. With canvas carrying case. . . 2.25

Special 12 Pc. SPORTSMAN'S KNIFE

Only 4.95

Eliminates 12 Items from Pack or Tool Kit
Complete with LEATHER HOLSTER

Here is the Perfect Combination Knife Tool for every Outdoor Sportsman Hunter, Camper, Fisherman, Boy Scout, Ranger, Rancher etc. Think of it! 11 Fine quality Steel Tools, precision made to fold easily into the heavy bone covered body. In one neat, compact unit you have 1) a regular knife, (2) a fork, 3) a spoon, (4) a draw knife, (5) a bone saw and fish scaler, (6) scissors, (7) a can and bottle opener, (8) a cork screw, (9) awl punch, (10) a screwdriver and (11) a metal file. All this PLUS a genuine leather, belt holster.

FLY THE FAMOUS F-86 SABREJET

The most exciting kit we've ever seen. Pre-formed ALL METAL fuselage with metal wing skin. Expertly detailed instructions make it easy to build. Designed for the tremendous speed delivered by a jet engine. 17.88

2 HP JET ENGINE

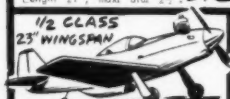
Designed to power the Sabrejet above. Develops 2.3 HP at 120 MPH with a 4 POUND THRUST. Comes with high voltage vibrator starting coil, wiring harness and spark plug. Length 21", max. dia. 2½". 27.88

EASY-TO-BUILD U-CONTROL JET

30" WING SPAN

1/2 CLASS

23" WINGSPAN



FAMOUS F-51 MUSTANG

The famous Mustang Fighter of World War II. Complete kit includes all parts and large easy-to-read plans. An ideal control line flyer for indoor and outdoor meets. An excellent model for the beginner. Can be powered by any Class A gas engine. 3.95

32" WINGSPAN CLASS 'B' AT-6 TRAINER

Complete kit includes die-cut fuselage formers and wing ribs, genuine rubber tires, pre-formed landing gear, pre-cut tail and body sections, etc. Polished Aluminum Cowling. All ready to assemble. Uses Class B engine. 5.95

B-26 INVADER – A beautiful twin engine job with 46" span. Kit is complete with polished aluminum cowls, molded canopy, rubber wheels and many parts pre-cut and shaped. An excellent U-line flyer. ONLY 12.99

PIPER SUPER CRUISER – Control line. 36" span. Complete kit ONLY 4.69
L-17 RYAN NAVION – Low wing, control line model – 27" wingspan. 6.95
F-4U CORSAIR – Famous Navy fighter. 20" span. For Class A engine. 2.99
JAP ZERO – Very maneuverable U-line flyer. 28" span. Complete kit. 3.69

.099 GAS ENGINE

Ideal for Control-line or Free Flight models. Operates on 'glo-plug' without ignition system. Turns 9,000 to 12,000 RPM. Develops .15 HP. 4½ ozs. Complete with 'glo-plug'. 4.95

.29 GAS ENGINE

Develops 2/5HP at 14,000 RPM. Rated Class 'B'. Displacement is .29 cu. in. Operates on glo-plug without ignition system. Designed for planes up to 30", boats, race cars. 7.75

12" ELECT. BOAT KIT

Here is a genuine electric motor driven speedboat that will make many a young sailor happier. The hardwood hull and deck are already completed (excepting paint) and is ready for final assembly. Included in this complete kit is an electric motor, flexible coupling, drive shaft with propeller, adjustable rudder, windshield, electric spotlight and other accessories and hardware. Can be finished and ready for launching in one hour. Motor and spotlight operate on 2 standard flashlight batteries

ONLY 3.95 WITH MOTOR

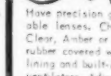
NEW 18" HYDROPLANE

The sleek, single-step hull is made of special hardwood. Hull sections are pre-formed and shaped making construction fast and easy. All parts including metal framed, plastic windshield are furnished. Hull is designed to use miniature, electric outboard motor (described below). Complete kit 4.95 LESS MOTOR

ELECTRIC OUTBOARD MOTOR

Runs on two flashlight cells. Enough power for boats up to 18". Has tilt-swivel mount. Propeller diameter 1". Ready to go! 2.69

GENUINE AN6530 ARMY AVIATORS GOGGLES



Have precision ground, interchangeable lenses. Choice of 3 colors – Clear, Amber or Green. Frames are rubber covered with a soft, chamois lining and built-in, non-fogging lens ventilators. Adjustable nose bar. An elastic headband. WINDPROOF DUSTPROOF! Genuine Air Corps Surplus. NEW Give lens color choice. 2.49
EXTRA LENSES – color above. 1.00

10 POWER NAVY SPYGLASS

Made by Wollensak for the U.S. Navy, Bureau of Ships. A genuine 10 Power Spyglass as used by the Officer of the Deck. Has finest quality, fully coated precision ground lenses with adjustable eyepieces. Overall length is 22-3/4". Comes in a handsome hardwood case.

USED – but like new – 22.75 ALL NEW 29.95

SEXTANT TYPE STADIMETER

An optical instrument for measuring the exact distance between two points. Originally used by the Navy. Complete set includes Stadimeter miniature telescope and complete instructions for use. Comes beautiful, polished hardwood case. A Bargain at 17.95

AIR CORPS SEXTANT

Can be used for any navigational purpose. Contains many valuable optics, lenses, prisms, gears, drives, spring motor, bubble level, etc. Can be used as is. Comes with sturdy plastic bag. 17.95

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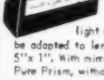

Made of finest optical glass. Bends light rays 90 degrees. Can be adapted to lens, lights, etc. Size 5"x 1". With mirror reflector – 59¢
Pure Prism, without mirror – 2.25

NEW 4-SPEED HOBBY MOTOR

A rugged precision built electric motor. Operates on 110 volt, 60 cycle current. Was originally made for the Navy – now converted for YOU! Has four take-off shafts for 5, 25, 150 and 4000 RPM. Ideal for grinder, drill, driving light tools, displays, etc. 9.95

16 POCKET VEST

The ideal jacket for the Rifleman or Hunter . . . Has 14 individual, outside pockets for shells, glasses & other accessories. 2 large (11" x 8") inner pockets, a leather holder for knife, gun or tool. Sturdy, yet light weight with tie-straps at back for adjustable fit 3.49

ARMY CANTEEN BELT & CUP

Genuine U.S. Army Equip. The 1 quart canteen and aluminum cup with folding handle fit snugly into the insulated canvas cover. Cover attaches to web pistol belt which has metal grommets for hooking on other gear. 2.59

27" LONG NEW ARMY MACHETTE

Use around camp for clearing brush etc. Has a 22" Vanadium steel blade. Hardwood handle. 27" overall length. Complete in rugged belt sheath. 1.98

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Used by Navy for Gun Control. An ideal emergency communication system because each set is 'sound' powered—no other power needed. Will reach any point-to-point in a radius of 1/2 mile. Each set includes 2 phones on chest plate, 2 headsets, button switches and approx. 35 ft. of wire. PER SET **9.95**

U.S. ARMY FIELD PHONE

A private phone or intercom system. Ideal for use on target range, farms, mountains, forest or any place where portable two-way communication is desired. This is the famous EE-8 field phone used to success by the Signal Corps. Gives clear reception up to 15 miles. Uses two standard batteries. Set consists of a ringing generator, one phone, all contained in the original handy carrying case. Several of these phones can be used on one line. Reconditioned, checked out. Price per ea. phone. **14.95**
Price for a SYSTEM—two sets . . **29.50**

EE99A PHONE SIGNAL BOOSTER

Originally designed as a booster for long-line field telephone hook-up. Also serves as a monitoring station and a tie-in point for trench lines. Can be adapted to use with battery operated phone system where long transmission lines are necessary. Unit contains many valuable parts such as switches, relays, pots, etc. **8.95**

ELECTRONIC GOLDMINE

Here's a bargain for 'hams', novices and radio hobbyists. This unit contains a wealth of miscellaneous parts. Included are approx. 40 resistors in values from 120 ohms to several megs in sizes from 1/4 to 2 watts. There are 25 ceramic capacitors of various mfd and wvdc. 6 'bathtub' electrolytics, 3 multi-pole relays, 12-8 pin sockets, hook-up wire, 2 metal boxes and a 12"x 8"x 2" chassis, plus many other valuable parts. ONLY **2.49**

5 DRAWER FASTNER KIT

A typical Palley Bargain Buy! Here's a 5 drawer steel cabinet jammed full of fabric fasteners, rivets, etc. Included are metal grommets, twist fasteners, snap fasteners, speedy rivets, etc. Also included is a Hand Press complete with punches and dies for installation. You will look a long time to beat this. **28.95**

U.S. NAVY WADING SUIT

$50.00 VALUE

Ideal for use wherever it is necessary to protect yourself from water, mud, silt, etc. Covers the entire body from neck down. Originally designed as Overboard Suit for landing operations. Made of heavy duty rubberized canvas with vulcanized seams. Has built-in boots and gloves. Sizes large, med., small. $35 value. ONLY **8.95**

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Genuine Select PHILLIPINE MAHOGANY LUAN PLYWOOD

Ideal For Fine CABINET WORK, FURNITURE, Paneling DENS, OFFICES, HOTELS, etc.

Our prices are LESS THAN DOMESTIC PLYWOOD at WHOLESALE. This selected LUAN MAHOGANY meets the most rigid specifications. It is WEATHER and WATER RESISTANT. You'll be amazed at the beauty of this fine wood. Its rich golden elegance will thrill you. Rotary cut for beauty of grain. Both sides sanded and ready to use. Bonded with finest resin adhesive. Face side unjointed.

See for YOURSELF FREE SAMPLE on request!

Available in three thicknesses — 3mm (approx. 1/8") 4mm (approx. 3/16") and 1/4". All orders shipped by Special Truck for lowest rates. No order accepted for less than 100 lbs. — equal to (8) 3mm sheets, (6) 4mm sheets or (4) 1/4" sheets. . . . . .

3mm (1/8") x 3 ft. x 6 ft.	4mm x 4 ft. x 6 ft.	1/4" x 4 ft. x 8 ft.
$5.00 VALUE	$7.50 VALUE	$9.50 VALUE
1.79 PER SHEET	3.89 PER SHEET	4.99 PER SHEET
Minimum order 8 sheets	Min. order 6 sheets	Min. order 4 sheets

QUALITY WOOD LEGS WITH BRASS TIPS BUILD OR RESTYLE YOUR FURNITURE

Beautifully turned, fully seasoned hardwood legs. Smoothly sanded and complete with brushed Brass tip and sturdy steel mounting plate. Available Finished or Unfinished — Finished units come in Blonde, Silver Fox, Mahogany or Charcoal Black. Please Specify type.

Price per set of 4 with Brass tip.

SIZE	FINISHED	UNFINISHED	SIZE	FINISHED	UNFINISHED
4"	$2.65	$2.15	14"	$4.[illegible]	$3.95
6"	3.00	2.65	16"	4.75	4.40
8"	3.55	3.00	18"	5.35	4.75
12"	3.95	3.55	28"	6.25	5.35

3400 RPM 1/2 HP POWER SAW

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COMPARES TO SAWS SELLING UP TO $49.50 **19.98** Complete with 5-1/2" Blade

A rugged, professional type, adjustable saw. Will cut any angle from 0 to 45°. Has an adjustable (0 to 6") rip fence. Safety-trigger switch on handle. Full 1/2 HP Universal AC-DC, 110-120 Volt, 60 cycle motor. Weighs only 6 1/2 lbs. Thousands already sold. Your satisfaction guaranteed.

PALLEY 100-200-300 POWER MICROSCOPE

An ideal Gift for the Student, Amateur Scientist, etc. Study insects, plant life, plant tissue, etc. Has fine ground and polished lenses. Precision ALL-METAL construction — this is NOT A TOY! The triple, revolving objective lens turret will allow you to select 100X — 200X or 300 power magnification. Has right or left hand rack & pinion adjustment for smooth, precise movement. Body inclines 90°. Adjustable plane sub-stage mirror. Complete in sturdy, dovetailed hardwood case. Guaranteed 1 YEAR! Only **8.95**

AAF SURVIVAL PONCHO

PONCHO AS A TARP

Complete Rain Protection. Dark Blue outside, gold inside. Extra roomy. May be used as emergency tent or tarpaulin, also makes fine ground cloth. Has hood with tie string at throat. ONLY . . **3.95**

SAVE! NEW METAL WORKING CARBON STEEL TWIST DRILLS

Some of the best that money can buy. Original Navy equipment. Never used. Very good condition. A saving.

1 to 1 1/16" **1.65** EA. 1 1/4 to 1 1/2 **1.99** EA.

52000 NEW HAND TAPS

Taper and bottoming types. Never used and in good condition. In sizes 3/4"-9NC; 7/8"-9NC and 1 1/8"-7NC.

VALUES UP TO $8.00 **55¢** EA.

NEW ELECTRIC ACTUATOR

Has a 5-1/4" stroke. Delivers and 800 pound thrust and will stand a 1750 pound static load. Motor operates on 24 volts DC at 11 1/2 amps. Turns 7500 rpm. Overall length, eye-to-eye is 13 inches. **9.95**

HOIST ONLY 32.50

$110.00 VALUE

Excellent for Machine Shops, Garages, Trucks, Tractors, Boats, etc. Will lift up to 2500 pounds through its 24 to 1 gear ratio. Has a bronze worm gear drive. Comes with 18 ft of high tensile strength 3/16" steel cable.

HOIST MOUNTING FRAME Specially designed for mounting the above winch. Frame only **4.50**

PORTABLE WINCH HOIST

LIFTS 1500 POUNDS — Made originally as a Bomb Hoist. Has 21 to 1 gear ratio. A 40" tubular arm extension with a 3" pulley. Drum has 12 ft. of 3/16" steel cable. Operating handle has ratchet brake. For 'swing about' loading. $125 VAL. **22.50**

PRESSURE TANKS

G1 Type Stainless Steel. Shatterproof and rustless. Has reinforcing ribs and is pressure tested up to 400 PSI. Has high safety factor. 1/4" pipe ports. Ideal for use in air supply in underwater fishing, painting, spraying, etc. Also as pucy or for water supply. Size: 12 1/2" x 24". Stainless Steel. . . **12.95**

Corrosion Resistant Steel TANK — No. D-2. 500 cu. in. capacity. . . . **3.95**

180° OFFSET DRIVE

NEW

For use where tremendous power at low take-off RPM is desired. 6 gears rotate on self-lubricating, hi-speed roller bearings. 85 to 1 gear ratio. Shafts are 1 1/2" & 3/8" dia. USED NEW in excellent condition . . . **5.95** **8.95**

NEW JACK & HEINTZ 2-SPEED ENERGIZER

Used as auxiliary power source to actuate aircraft starters. Has 2-speed control for 200 RPM low or 275 RPM high. Heavy duty gear box gives extremely high torque. Power 110-115V AC. Easy to convert to many power uses. **27.50**

VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies piston hydraulic motor. Has 2 H.P. Automatic pressure dash pot for smooth control. Power output RPM — 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator setup on Mills, Conveyors, Small Cars, Drives, etc. **49.50**

4" SPLINE SHAFTS for input and power take-off on above. Pair $2.50

INPUT & TAKE-OFF PLATE ASSEM. To adapt Trans. to pulley drive. Has 1/2" keyway shaft. High speed bearings. **20.00** SET

SAVE 50% ON NEW PALLEY HYDRAULIC CYLINDERS

Send for our NEW CATALOG showing our complete line of Hydraulic Supplies and Equipment. Contains many new items now being manufactured by us to meet most rigid specifications. We also have many new surplus items.

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Movable models whittle a big airplane plant down to size for more efficient planning.

Toy Room Speeds Airplane Production

THE man held a 137-ton metal-stretching press with two fingers, while several F-84 Thunderstreak jet fighter-bombers rested in the palm of his other hand. He was trying out some changes in Republic Aviation's 560-acre plant layout at Farmingdale, N.Y.

It was all in miniature. Otherwise the man would have been 288 feet tall, with muscles to match, clomping 48-foot brogans down the assembly-line aisles with 144-foot strides. Instead, on the quarter-inch-to-one-foot scale, the 43-foot Thunderstreaks are only 11 inches long, and the tiny chef in the company's cafeteria stands just over an inch and a half to the top of his floppy white hat.

It takes some 50,000 three-dimensional miniatures, from huge milling machines to telephones, drinking fountains, and even an X-ray machine in the hospital, to make up this $60,000 toy room. The models are not playthings, but planning tools for Republic's industrial engineers.

MODELMAKER Mario Donaudy puts the finishing touches on a Thunderstreak fighter-bomber.

I saw my job failure in my family's eyes

. . . but how they smiled when I. C. S. pulled me through

Take it from me. That's the hard way to discover a mistake.

I thought I was in solid down at the plant with my years of experience. They'd never lay *me* off.

But they did. And I *was* in solid—as long as business was good. But when things started getting tight . . .

"In times like these," the boss told me, "everybody has to pull his own weight and a little more. Experience is more than just adding up years. You have to learn something, too."

I was sore, sure. But when I calmed down I realized he was right. I decided then to start learning. I signed up for an I. C. S. Course, studied at home in my spare time.

Then I went back to the plant. The boss was so impressed with my I. C. S. diploma, he gave me another try . . . and soon after I even got a raise!

TRAINED men are in demand

It's a fact. *Right now* there are plenty of job opportunities for trained men. How do you get training and hold down a job at the same time? Simple. Study with I. C. S. at home, in your spare time, at a cost of only pennies a day.

I. C. S. is the oldest and largest correspondence school. 277 courses. Business, industrial, engineering, academic, high school. One for you. Direct, job-related. Bedrock facts and theory plus practical application. Complete lesson and answer service. Diploma to graduates.

3 FREE BOOKS

1. "How to Succeed," a gold mine of job tips that will open your eyes to your own mistakes. **2.** An outline of job opportunities in the field of your choice. **3.** A sample I.C.S. lesson text. Send for them today.

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- ☐ Painting Contractor
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- ☐ Reading Arch. Blueprints

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- ☐ Fashion Illustrating
- ☐ Magazine Illustrating
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

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- ☐ Auto Elec. Technician
- ☐ Auto-Engine Tune Up
- ☐ Automobile

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Training Tomorrow's Air Force Generals

[*Continued from page 120*]

of an Aircraft Observer when he graduates. Aerial navigation is considered to be the ideal foundation for future specialization as a pilot, a navigator-bombardier or an operational officer in electronic countermeasures, guided missiles or other fields of Air Force activities.

On graduation day, in addition to his navigator's wings, the cadet will receive a Bachelor of Science degree and become a second lieutenant in the Air Force.

Rounded education. Mindful that a future commander in an Air Force with world-wide bases and responsibilities must be well grounded in many matters besides aeronautics, the Academy has laid out a curriculum devoted 50 percent to social studies and the humanities.

Each cadet will get four years of English and history, and in addition will study philosophy, geography, psychology, law, economics, governmental systems, international relations and business management. In his senior year, he will be given a choice between a heavy dose of a foreign language, with emphasis on speaking and understanding it, and an equally massive course in aircraft design.

On the technical side, he will study mathematics, chemistry, graphics, physics, mechanics and materials, electrical engineering and electronics, thermodynamics and aerodynamics. In addition, in his training to become an aircraft observer, he will be given intensive ground and flight training in dead reckoning, celestial and polar navigation, pressure-pattern flying, loran and radar, and he will be introduced to the special techniques and equipment required in high-speed, high-altitude planes of the latest types.

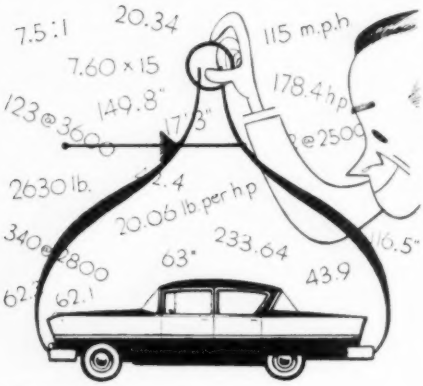
His summers, apart from an annual four-week leave, will be filled with flying visits to principal U.S. installations of the Air Force's chief commands and services, and with military training.

Gridiron hopes. Cynics were quick to comment that one of the chief purposes of founding an Air Force Academy was to field a football team capable of scalping West Point and Annapolis. Doubtless this is a dream shared by all concerned at USAFA, but its realization seems likely to be a long time coming.

So stiff are the scholastic requirements for eligibility that a player is knocked out of intercollegiate competition if he slips below an average grade of 70 in even one of his nine subjects.

West Point and Annapolis needn't start trembling just yet. END

NEXT MONTH: Facts and Figures on All 1956 Cars



WHAT U.S. car has the lowest weight per horsepower? Which has the most weight per square inch of brake lining? Do you know the headroom in the Continental, the rear-axle ratios in the Rambler, or whether a Buick will fit in your garage? Got any idea of an Imperial's turning circle, or how many carburetor barrels a Cadillac Eldorado has?

A special section in February POPULAR SCIENCE MONTHLY will give dimensioned drawings of every 1956 make of U.S. car, plus detailed specifications on engines, transmissions, and running gear. It's an issue you'll study and save.

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Porter-Cable quality in this all new

finishing sander

only $39.50

Here's the great new finishing sander that's got *everyone* talking—with a price tag *anyone* can afford!

It's Porter-Cable's Model 145—and it's a honey! Use it for coarse, medium, and fine finishing on wood, metal, plastics, glass, and many other materials—do hundreds of sanding jobs faster and easier!

Orbital motion lets you sand with, against, or across the grain, with never a gouge or ripple. Husky Universal motor has all the speed and power you'll ever need—lightweight, *balanced* design prevents fatigue.

Best of all, this rugged new Sander is built to Porter-Cable's uncompromising *quality standards* – which means long life, trouble-free service, *value* far beyond its price. See and try it soon!

MODEL 145 — ONLY $39.50 COMPLETE
Precision ball and bronze bearings throughout. Standard 9 x 11 sandpaper size provides 4 abrasive sheets for the 145. Quick-change paper clamps, sturdy die-cast aluminum housing. Weight, 5½ lbs.

SEE YOUR DEALER — OR MAIL COUPON TODAY!

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Yes, send me a complete catalog sheet on the Model 145 Finishing Sander, and the name of my nearest dealer.

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This South Bend 9" Precision Lathe is the basic tool for your shop. It enables you to perform accurately the same full range of operations done on South Bend Lathes in industry. Also, operations ordinarily performed on other machine tools are made possible through the use of efficient attachments. You get more for your money in a South Bend 9" Lathe.

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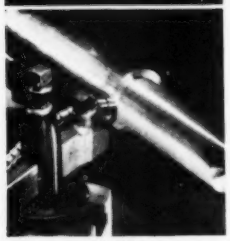
A Few of the Many Operations You Can Perform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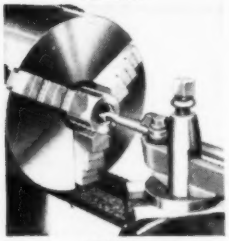
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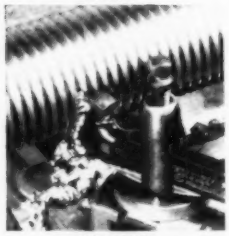
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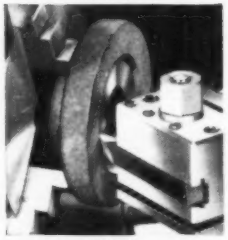
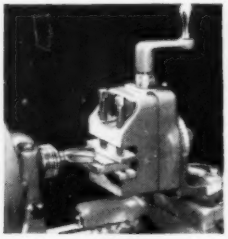
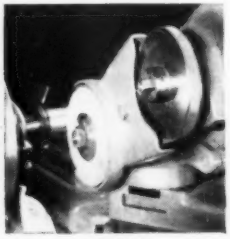
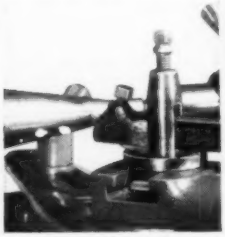
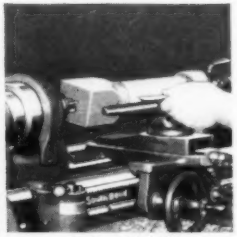

FACING


MILLING


GRINDING


TAPER TURNING


WOOD TURNING

ain You AT HOME in Spare Time for Jobs in RADIO-TELEVISION

America's Fast-Growing Industry Offers You

1. EXTRA MONEY IN SPARE TIME

Keep your job while training at home. Many NRI students make $10, $15 a week extra fixing neighbors' sets in spare time, starting soon after enrolling. The day you enroll I start sending you special booklets that show you how to fix sets. You use the Multitester built with equipment I furnish to locate and correct set troubles. Adam Kramlik, Jr., Sumneytown, Pa., wrote: "Earned $12 to $15 a week, spare time. Now have my own Radio-TV shop."

2. GOOD PAY JOB

Radio-Television growth and expansion and new uses for known principles are making more jobs for well-trained men. There are over 3000 Radio Broadcasting Stations on the air giving good pay to operators, technicians. Over 115 million home and auto Radios are now in use, providing full time and spare time servicing opportunities. Government, Aviation, Police, Ship, Micro-wave Relay, Two-way Radio Communications for buses, taxis, trucks, railroads are growing fields of opportunity.

3. BRIGHT FUTURE

About 200 Television stations are now on the air from coast-to-coast. Hundreds more being built and hundreds of others authorized. These new stations will need operators, technicians. More than 25 million Television sets are already in use and require servicing. Thousands more Television sets are being sold every week and need installation, servicing. Act now to qualify for a good job or your own sales and service business. Cash in on this rapid growth.

Television is Making Good Jobs, Prosperity

Training plus opportunity is the PERFECT COMBINATION for job security, advancement. When times are good, the trained man makes the BETTER PAY, gets PROMOTED. When jobs are scarce, the trained man enjoys GREATER SECURITY. NRI training can help assure you and your family more of the better things of life. My training is practical, complete; is backed by 40 years of success training men at home. My well illustrated lessons give you basic principles you need and my skillfully developed kits of parts "bring to life" things you learn from the lessons.

Find Out What Radio-Television Offer You

Without obligating you in any way, I'll send an Actual Lesson to prove that training at home is practical. I'll send my 64-page book to show good job opportunities for you in Radio-Television, show equipment you build, show what my graduates are doing and earning. Terms for NRI training are as low as $5 a month. Many graduates make more in two weeks than the total cost of my training. Mail coupon now. J. E. SMITH, President, National Radio Institute, Dept. 6AB, Washington 9, D. C. OUR 40TH YEAR.

ce Broadcasting *with Parts I Send*

dcasting Course I send you kits of parts to build the low-Transmitter shown at left. You use it to get practical experience putting a station "on the air," performing procedures demanded of broadcasting station operators. An FCC Commercial Operator's License can be your ticket to a better job and a bright future. My Communications Course gives you the training you need to get your license. Mail card and see in my book other valuable equipment you build.

You Practice Servicing *with Parts I Send*

Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use parts I furnish to build many circuits With my Servicing Course at right. You build a Multi- s while training. Many stu- fixing sets in spare time, ng. All equipment I send is for Actual Lesson and Book

The Tested Way to Better Pay

I TRAINED THESE MEN AT HOME FOR SUCCESS IN RADIO-TELEVISION

Now Has Own Shop. "Got laid off my machine shop job which was best thing that ever happened to me as I opened a full time Radio shop."—Ernest T. Slate, Corsicana, Texas.

Radar Job plus Spare-Time Earnings. "I have a job working on radar equipment. Also do spare-time radio and TV servicing. Have my own amateur radio station W3PRN."—F. Zawake, Scranton, Pa.

First Job Thru NRI. "My first job was operator with KDLR obtained for me by your Graduate Service Dept. Now charge of Radio Equipment for Police and Fire Dept."—T. S. Norton, Hamilton, Ohio.

Paid for Course Before Graduation. "By the time I graduated I had paid for my course, a car and testing equipment. Can service toughest jobs."—E. J. Streitenberger, New Boston, Ohio.

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Many NRI trained men start their own business with capital earned in spare time. Let me show you how you can be your own boss. Joe Travers, a graduate of mine, in Asbury Park, N. J. writes: "I've come a long way in Radio and Television since graduating. Have my own business on Main Street."

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SEE OTHER SIDE

Be a Success as a RADIO-TELEVISION Technician

See Inside

NRI Training Can Lead to Jobs Like These in Radio-Television

BROADCASTING: Chief Technician, Chief Operator, Power Monitor, Recording Operator, Remote Control Operator. SERVICING: Home and Auto Radios, P.A. Systems, Television Receivers, Electronic Controls, FM Radios. IN RADIO PLANTS: Design Assistant, Service Manager, Tester, Serviceman. SHIP AND HARBOR RADIO: Chief Operator, Radiotelephone Operator. GOVERNMENT RADIO: Operator in Army, Navy, Marine Corps, Forestry Service, Dispatcher. AVIATION RADIO: Transmitter Technician, Receiver Technician.

Read What NRI Graduates Say

Owner of Appliance Store. "I own a third of the Grantsville Appliance Co. in my home town with a branch in Spencer, W. Va. Things look very good for the future."—B. Siers, Grantsville, W. Va.

$10 to $15 Week Spare Time. "Four months after enrolling, was able to service radios—averaged $10 to $15 week spare time. Now have full time business."—Wm. Weyde, Brooklyn, N. Y.

Works on TV Color. "My position with WNBT is video control engineer. I owe a lot of my success to your textbooks."—Warren Deem, Malverne, N. Y.

Chief Technician. "Within a year I opened my own full-time radio shop. NRI training qualified me as Instructor during war. Now Chief Radio and TV Serviceman."—P. G. Brogan, Louisville, Ky.

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